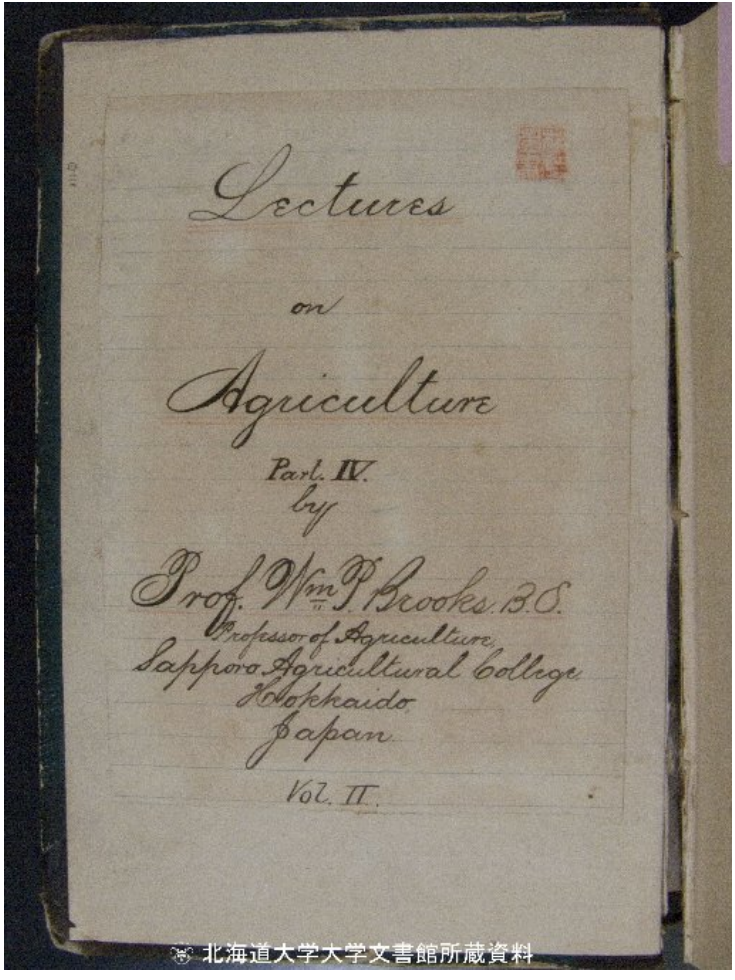

Lectures

on

Agriculture

Part IV.

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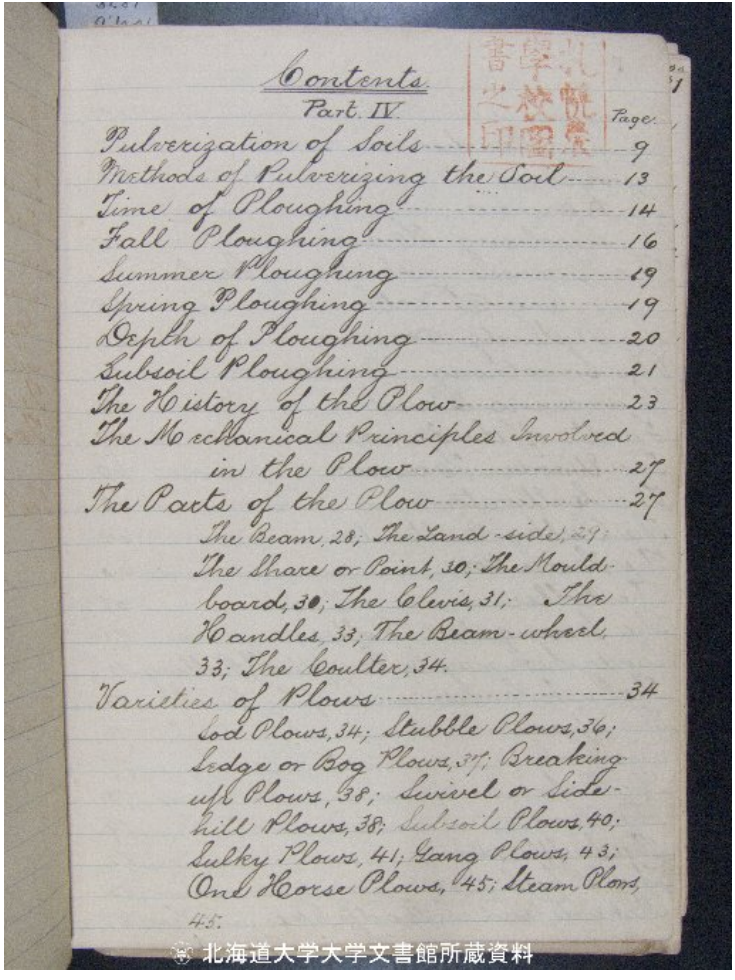
Vol. II



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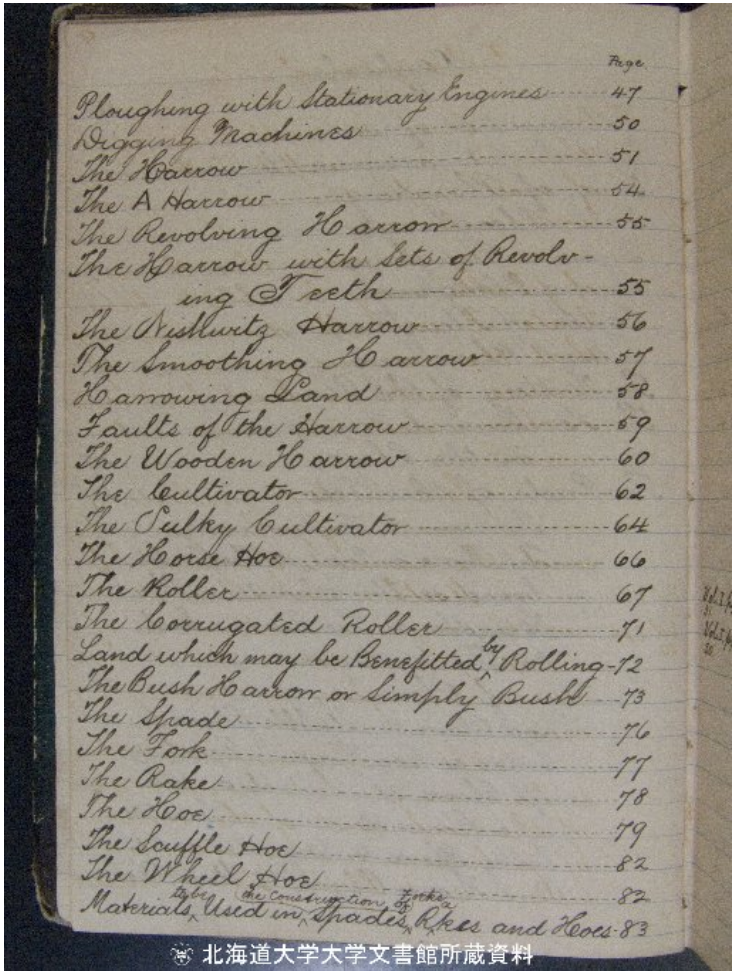
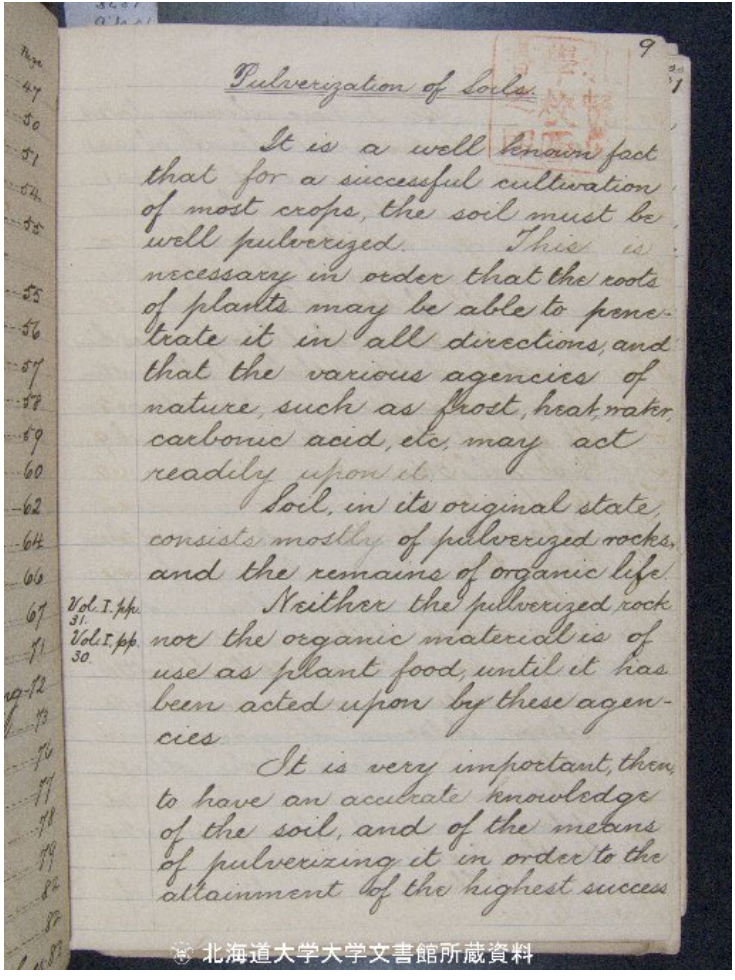




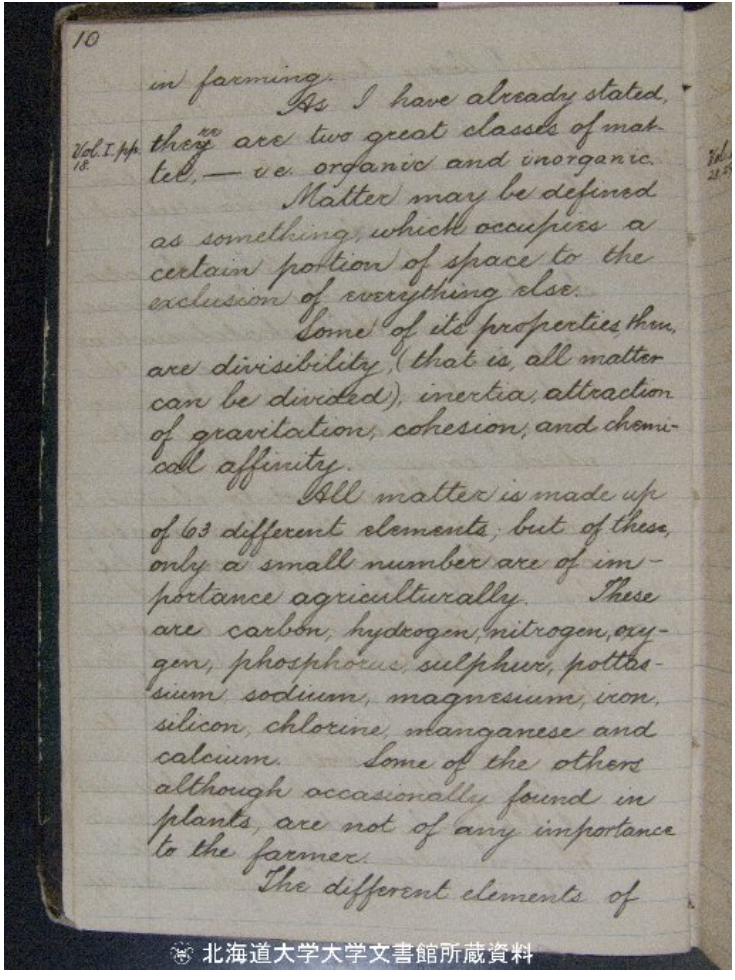
———— Pulverization of Soils. ————

It is a well known fact that for a successful cultivation of most crops, the soil must be well pulverized. This is necessary in order that the roots of plants may be able to penetrate it in all directions, and that the various agencies of nature, such as frost, heat, water, carbonic acid, etc, may act readily upon it.

Soil, in its original state, consists mostly of pulverized rocks, and the remains of organic life.

Neither the pulverized rock not the organic material is of use as plant food, until it has been acted upon by these agencies.

It is very important, them, to have an accurate knowledge of the soil, and of the means of pulverizing it in order to the attainment of the highest success



in farming.

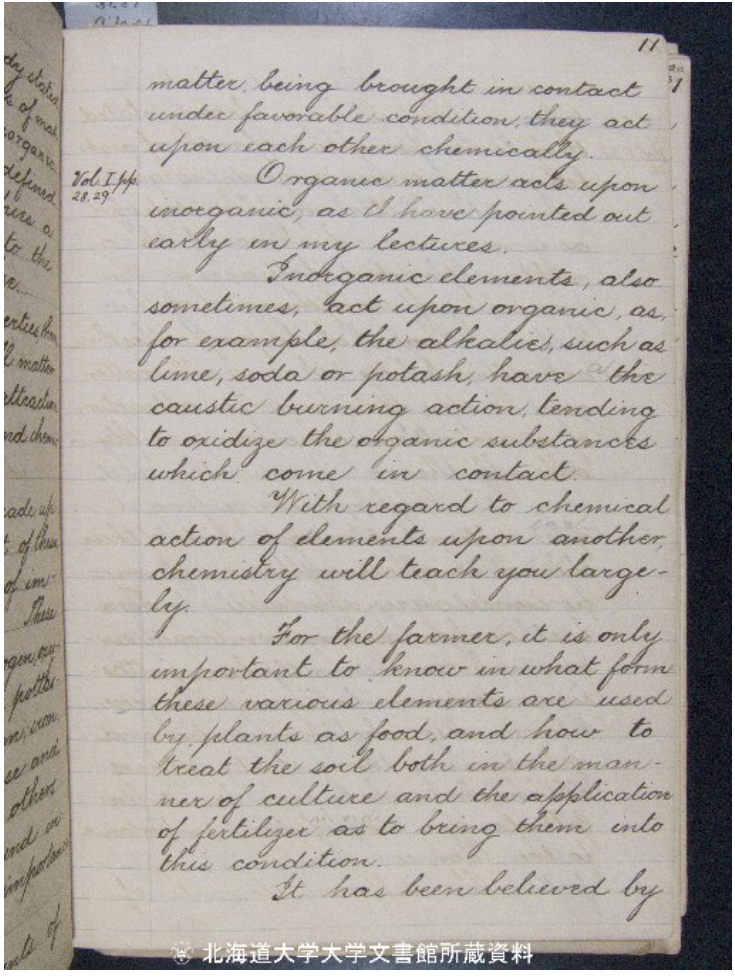
As I have already stated, there are two great classes of matter, —— i.e. organic and inorganic.

Matter may be defined as something, which occupies a certain portion of space to the exclusion of everything else.

Some of its properties, them, are divisibility, (that is, all matter can be divided), inertia, attraction of gravitation, cohesion, and chemical affinity.

All mater is made up of 63 different elements; but of these, only a small number are of importance agriculturally. These are carbon, hydrogen, nitrogen, oxygen, phosphorus, sulphur, pottassium, sodium, magnesium, iron, silicon, chlorine, manganese and calcium. Some of the others although occasionally found in plants, are not of any importance to the farmer.

The different elements of



matter, being brought in contact under favorable condition, they act upon each other chemically.

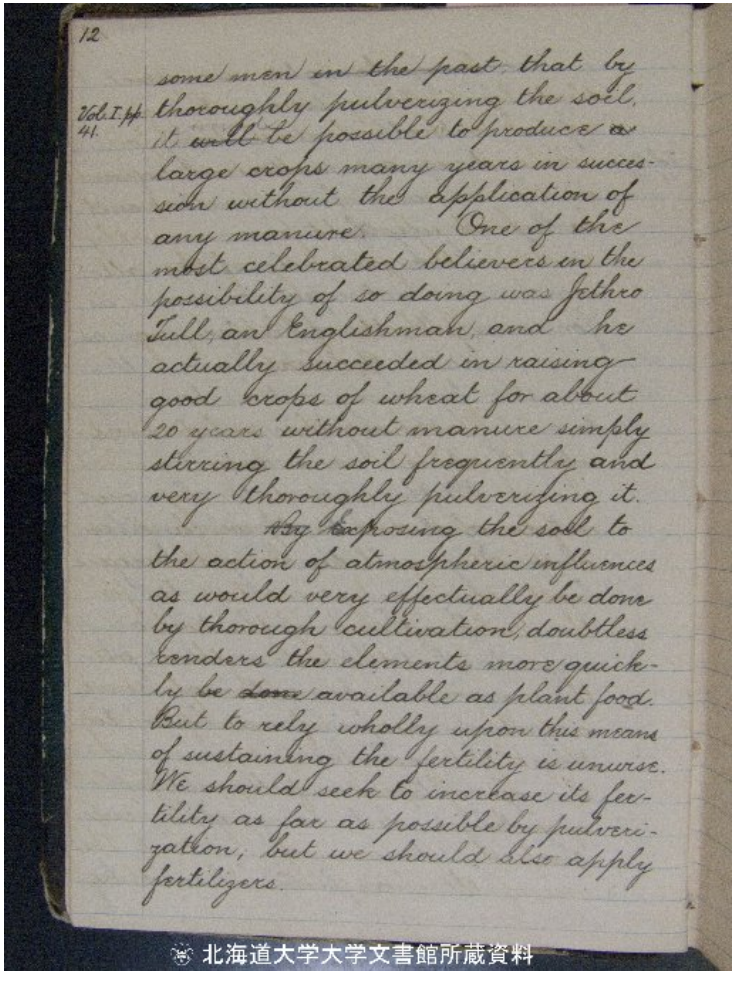
Organic matter acts upon inorganic, as I have pointed out early in my lecture.

Inorganic elements, also sometimes, act upon organic, as, for example, the alkalies, such as lime, soda or potash, have the caustic burning action, tending to oxidize the organic substances which come in contact.

With regard to chemical action of elements upon another, chemistry will teach you largely.

For the farmer, it is only important to know in what form these various elements are used by plants as food, and how to treat the soil both in the manner of culture and the application of fertilizer as to bring them into this condition.

It has been believed by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some men in the past that by
Vol I pp 41. thoroughly pulverizing the soil,
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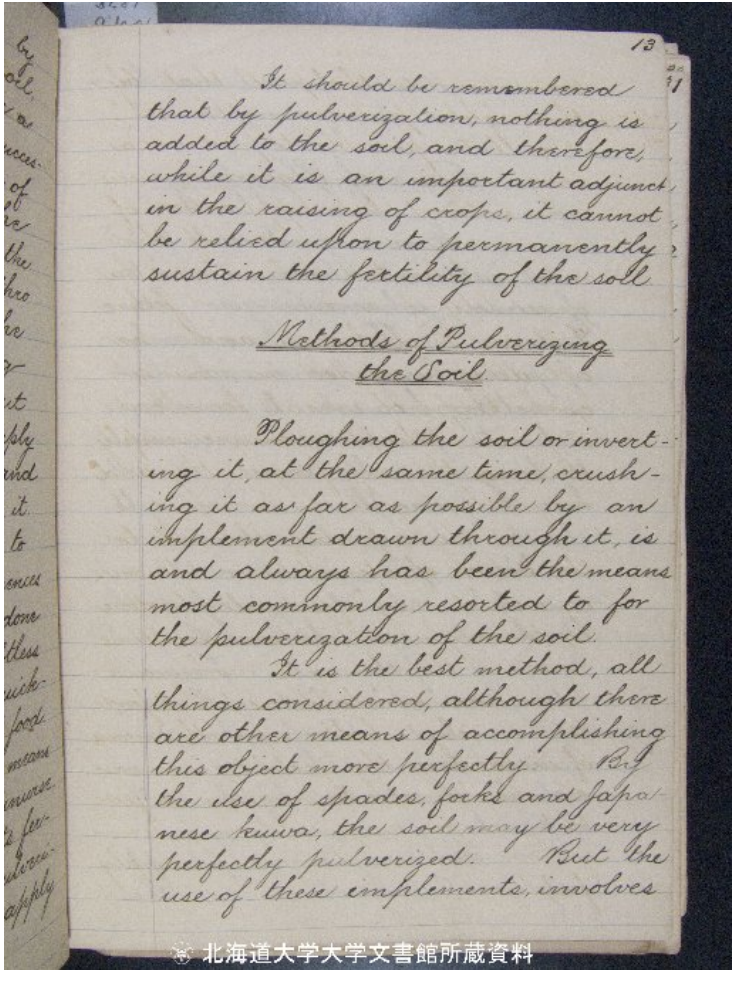
some men in the past, that by thoroughly pulverizing the soil, it is be possible to produce large crops many years in succession without the application of any manure. One of the most celebrated believers in the possibility of so doing was Jethro Tull, an Englishman, and he actually succeeded in raising good crops of wheat for about 20 years without manure simply stirring the soil frequently and very thoroughly pulverizing it.

Exposing the soil to the action of atmospheric influences as would very effectually be done by thorough cultivation, doubtless renders the elements more quickly be available as plant food. But to rely wholly upon this means of sustaining the fertility is unwise. We should seek to increase its fertility as far as possible by pulverization; but we should also apply fertilizers.

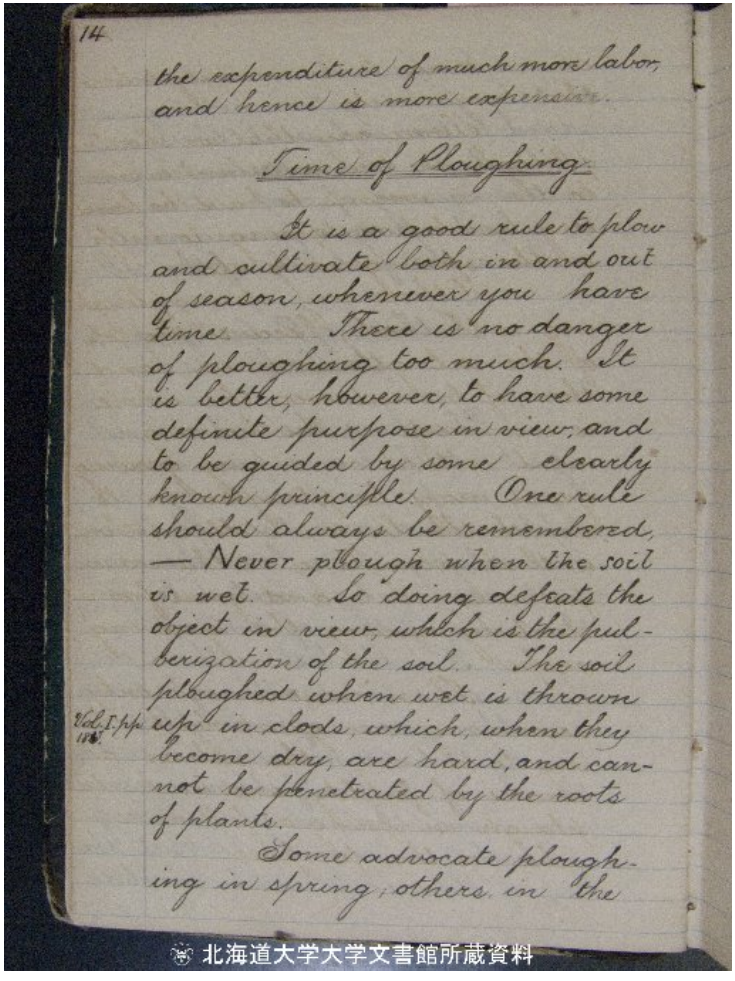


It should be remembered that by pulverization, nothing is added to the soil, and therefore, while it is an important adjunct in the raising of crops, it cannot be relied upon to permanently sustain the fertility of the soil.

Methods of Pulverizing the Soil.

Ploughing the soil or inverting it, at the same time, crushing it as far as possible by an implement drawn through it, is and always has been the means most commonly resorted to for the pulverization of the soil.

It is the best method, all things considered, although there are other means of accomplishing this object more perfectly. By the use of spades, forks and Japanese kuwa, the soil may be very perfectly pulverized. But the use of these implements, involves

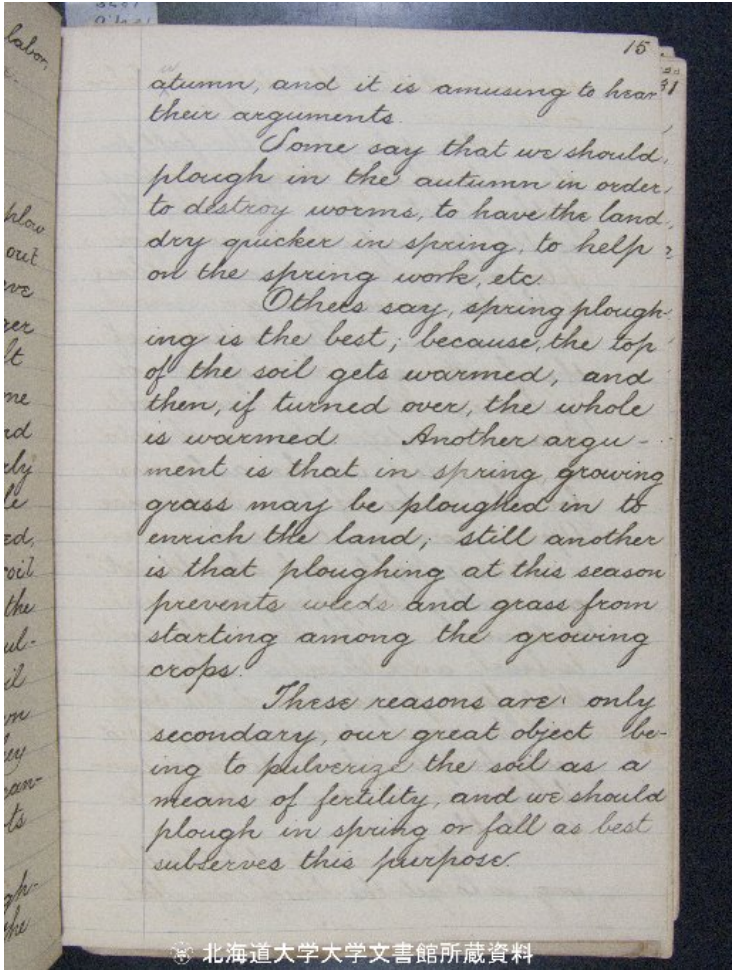


the expenditure of much more labor, and hence is more expensive.

Time of Ploughing.

It is a good rule to plow and cultivate both in and out of season, whenever you hove time. There is no danger of ploughing too much. It is better, however, to have some definite purpose in view, and to be guided by some clearly known principle. One rule should always be remembered, —— Never plough when the soil is wet. So doing defeats the object in view, which is the pulverization of the soil. The soil ploughed when wet in thrown up in clods, which, when they become dry, are hard, and cannot be penetrated by the roots of plants.

Some advocate ploughing in spring; others, in the

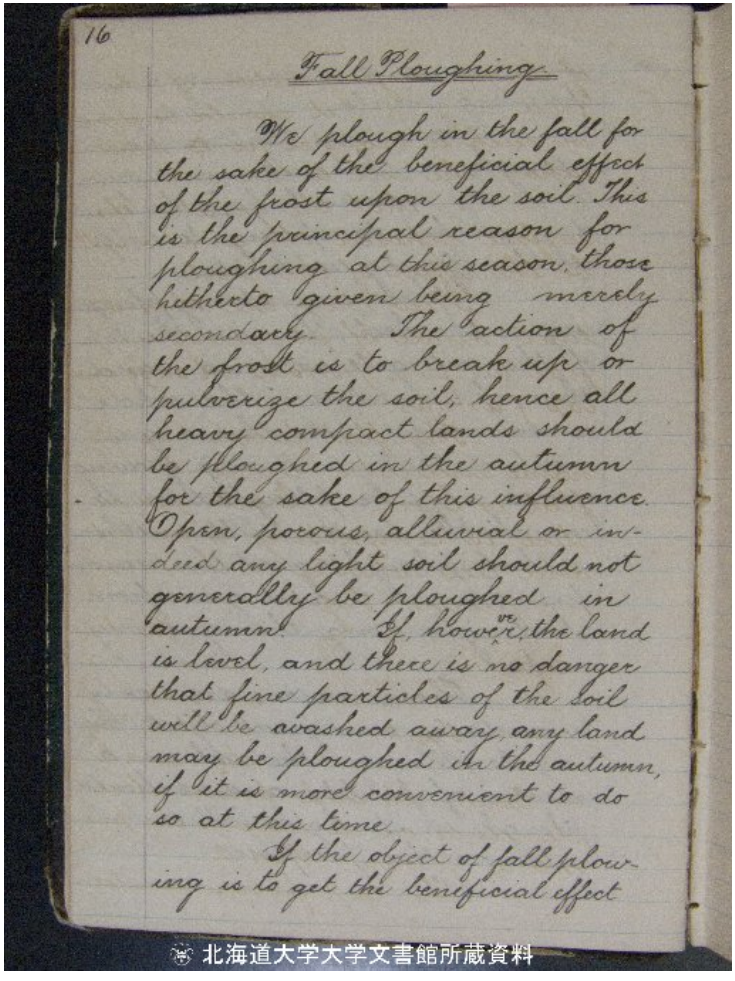


autumn, and it is amusing to hear their arguments.

Some say that we should plough in the autumn in order to destroy worms, to have the land dry quicker in spring, to help on the spring work, etc.

Others say, spring ploughing is the best; because, the top of the soil gets warmed, and then, if turned over, the whole is warmed. Another argument is that in spring growing grass may be ploughed in to enrich the land; still another is that ploughing at this season prevents weeds and grass from starting among the growing crops.

These reasons are only secondary, our great object being to pulverize the soil as a means of fertility, and we should plough in spring or fall as best subserves this purpose.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Fall Ploughing

We plough in the fall for the sake of the beneficial effect of the frost upon the soil. This is the principal reason for ploughing at this season, those hitherto given being merely secondary. The action of the frost is to break up or pulverize the soil, hence all heavy compact lands should be ploughed in the autumn for the sake of this influence. Open, porous, alluvial or indeed any light soil should not generally be ploughed in autumn. If, however, the land is level, and there is no danger that fine particles of the soil will be avashed away, any land may be ploughed in the autumn, if it is more convenient to do so at this time.

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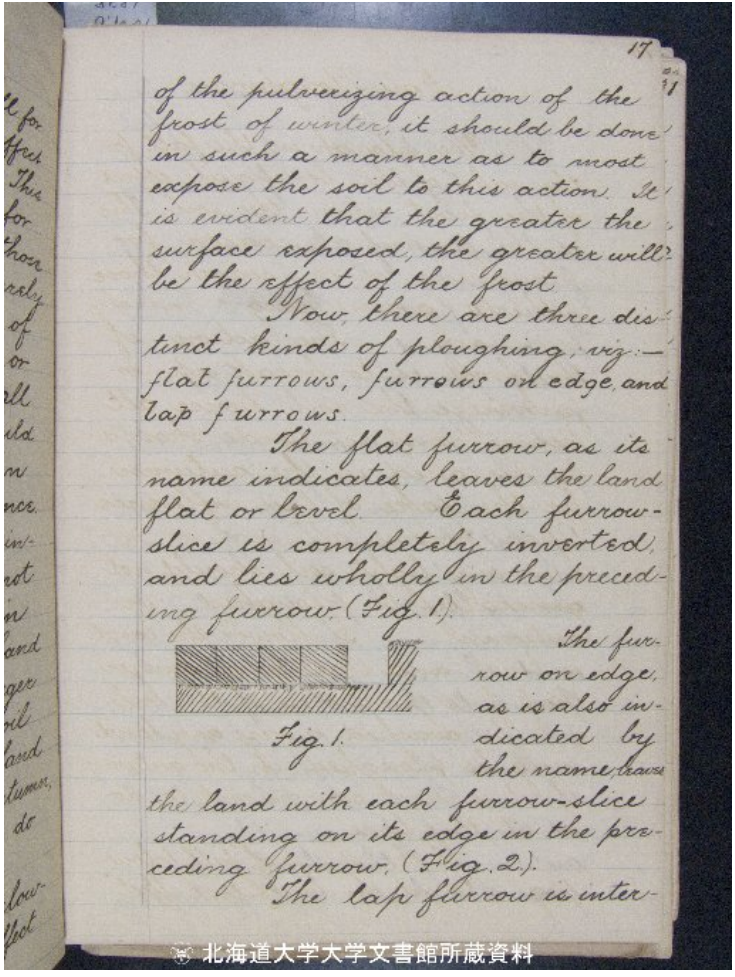

of the pulverizing action of the frost of winter, it should be done in such a manner as to most expose the soil to this action. It is evident that the greater the surface exposed, the greater will be the effect of the frost.

Now, there are three distinct kinds of ploughing; viz: —— flat furrows, furrows on edge, and tap furrows.

The flat furrow, as its name indicates, leaves the land flat or level. Each furrow-slice is completely inverted, and lies wholly in the preceding furrow (Fig. 1.).

「図」 Fig. 1.

The furrow on edge, as is also indicated by the name, because the land with each furrow-slice standing on its edge in the preceding furrow. (Fig. 2.).

The lap furrow is intermediate

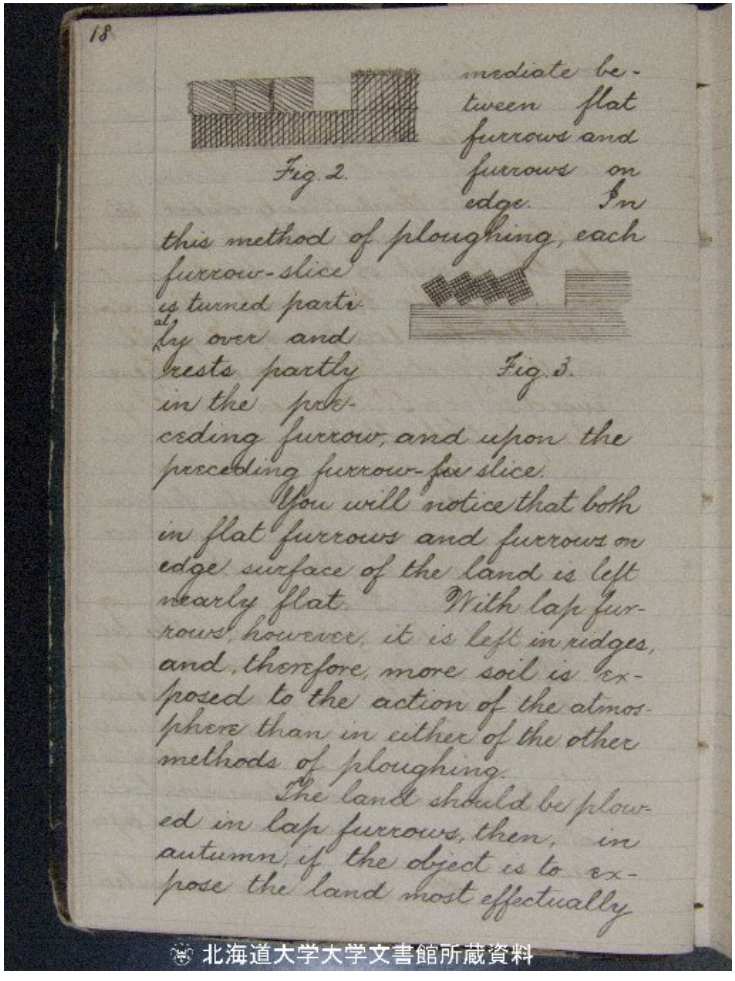
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Fig 2.

mediate between flat furrows and furrows on edge. In this method of ploughing, each furrow-slice is turned partially over and rests partly in the preceding furrow, and upon the preceding furrow-slice.

Fig 3.

You will notice that both in flat furrows and furrows on edge surface of the land is left nearly flat. With lap furrows, however, it is left in ridges, and, therefore, more soil is exposed to the action of the atmosphere than in either of the other methods of ploughing.

The land should be plowed in lap furrows, then, in autumn, if the object is to expose the land most effectually

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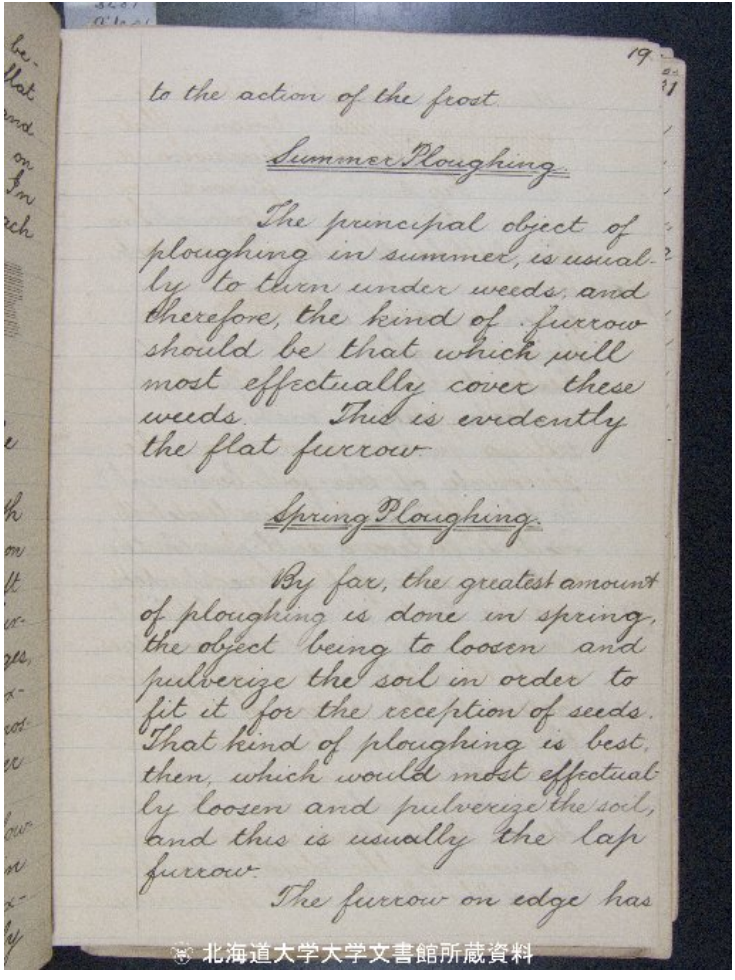


to the action of the frost.

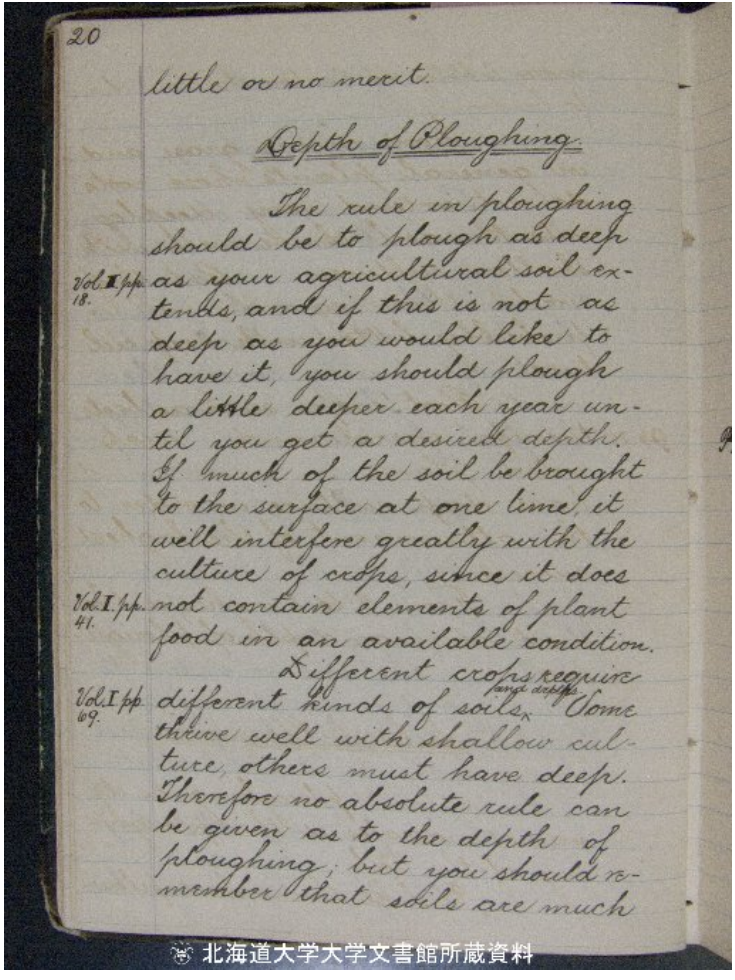
Summer Ploughing.

The principal object of ploughing in summer, is usually to turn under weeds, and therefore, the kind of furrow should be that which will most effectually cover these weeds. This is evidently the flat furrow.

Spring Ploughing.

By far, the greatest amount of ploughing is done in spring, the object being to loosen and pulverize the soul in order to fit it for the reception of seeds. That kind of ploughing is best, then, which would most effectually loosen and pulverize the soil, and this is usually the lapfurrow.

The furrow on edge

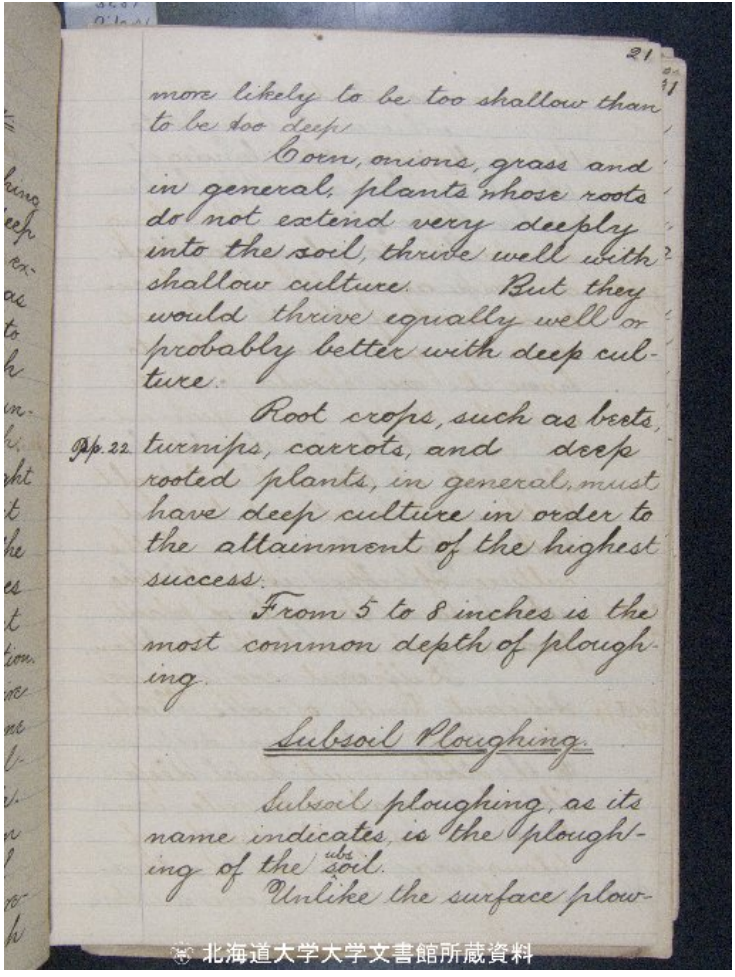


has little or no merit.

Depth of Ploughing.

The rule in ploughing should be to plough as deep as your agricultural soil extends, and if this is not as deep as you would like to have it, you should plough a little deeper each year until you get a desired depth. If much of the soil be brought to the surface at one time, it will interfere greatly with the culture of crops, since it does not contain elements of plant food in an available condition.

Different crops require different kinds of soils and depths. Some thrive well with shallow culture, others must have deep. Therefore no absolute rule can be given as to the depth of ploughing; but you should remember that soils are much



more likely to be too shallow than to be too deep.

Born, onions, grass and in general, plants whose roots do not extend very deeply into the soil, thrive well with shallow culture. But they would thrive equally well or probably better with deep culture.

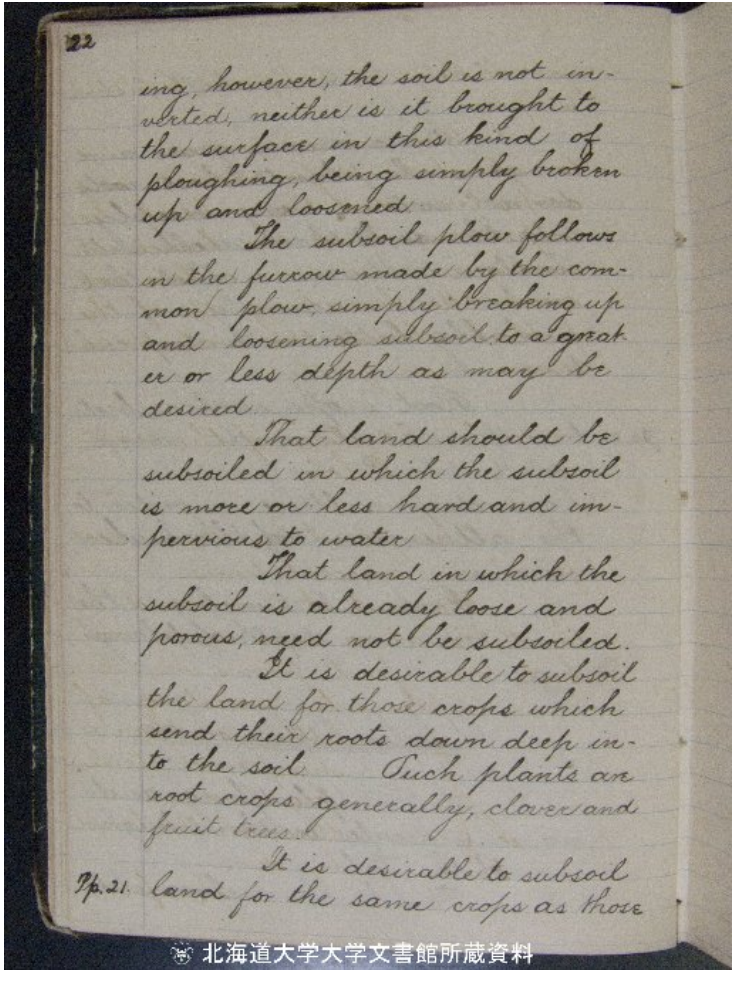
Root crops, such as bests, turnips, carrots, and deep rooted plants, in general, must have deep culture in order to the attainment of the highest success.

From 5 to 8 inches is the most common depth of ploughing.

Subsoil Ploughing.

Subsoil ploughing, as its name indicates, is the ploughing of the subsoil.

Unlike the surface plowing,



however, the soil is not inverted, neither is it brought to the surface in this kind of ploughing, being simply broken up and loosened.

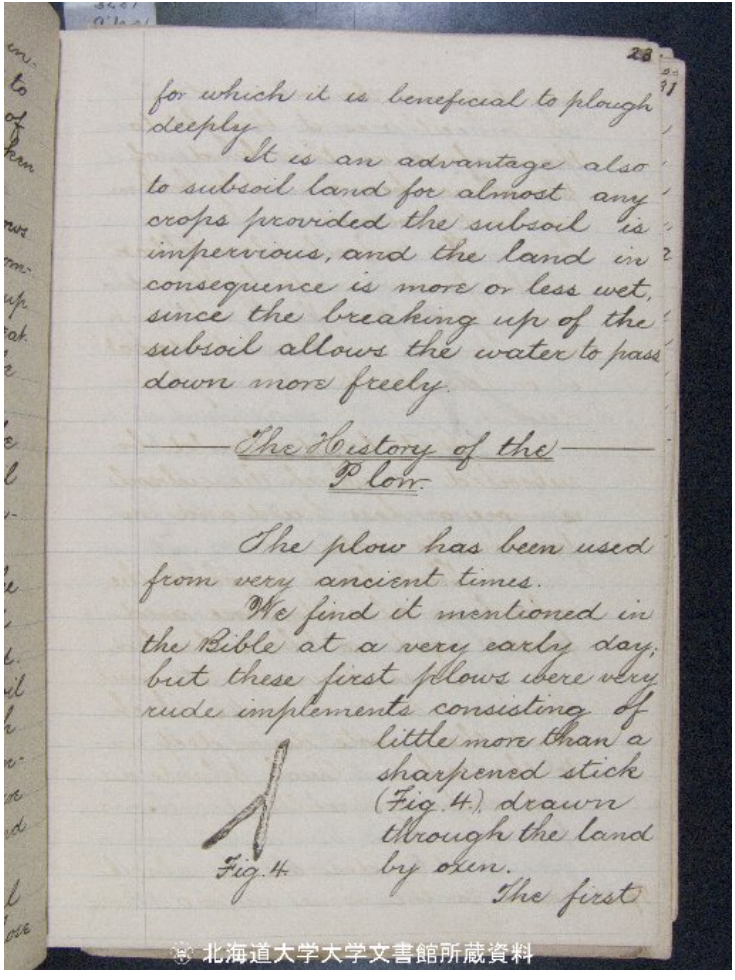
The subsoil plow follows in the furrow made by the common plow, simply breaking up and loosening subsoil to a greater or less depth as may be desired.

That land should be subsoiled in which the subsoil is more or less hard and impervious to water.

That land in which the subsoil is already loose and porous, need not be subsoiled.

It is desirable to subsoil the land for those crops which sand their roots down deep into the soil. Such plants are root crops generally, clover and fruit trees.

It is desirable to subsoil land for the same crops as those



for which it is beneficial to plough deeply.

It is an advantage also to subsoil land for almost any crops provided the subsoil is impervious, and the land in consequence is more or less wet, since the breaking up of the subsoil allows the water to pass down more freely.

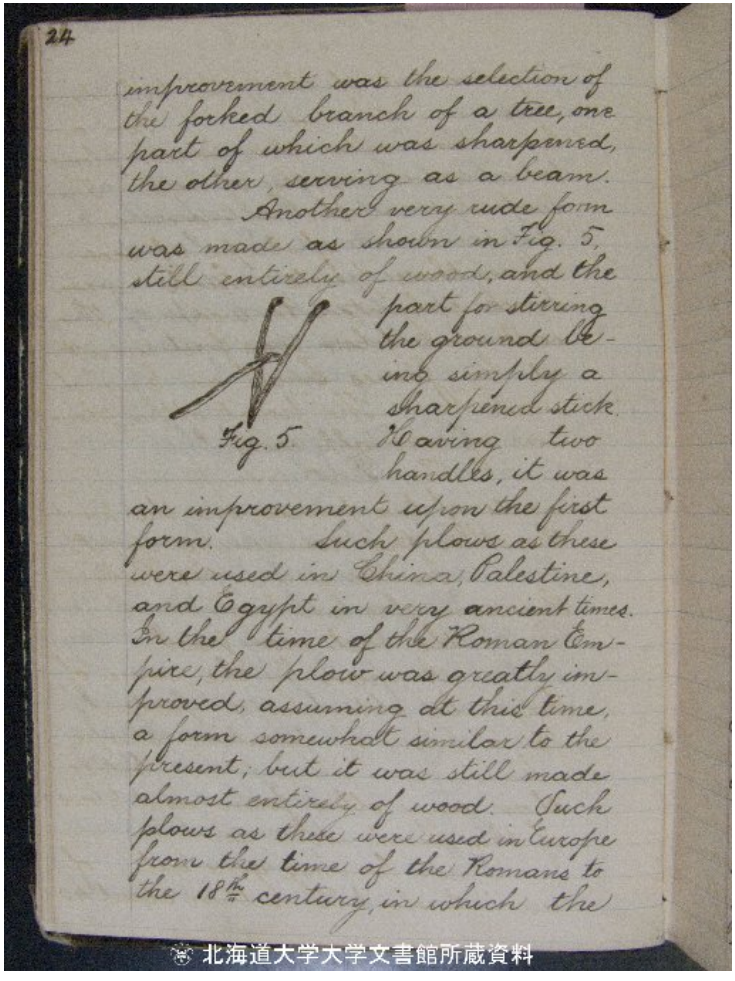
The History of the.

Plow.

The plow has been used from very ancient times.

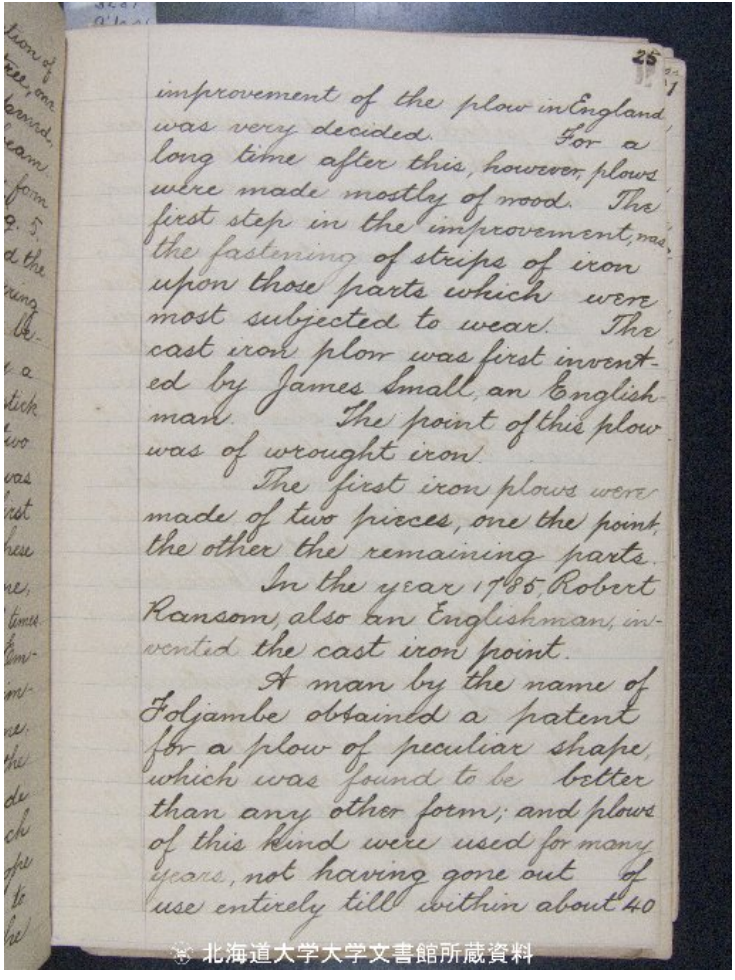
We find it mentioned in the Bible at a very early day; but these first plows were very rude implements consisting of little more than a sharpened stick (Fig. 4.), drawn through the land by oxen.

The first



improvement was the selection of the forked branch of a tree, one part of which was sharpened, the other, serving as a beam.

Another very rude form was made as shown in Fig. 5, still entirely of wood, and the part for stirring the ground being simply a sharpened stick. Having two handles, it was an improvement upon the first form. Such plows as these were used in China Palestine, and Egypt in very ancient times. In the time of the Roman Empire, the plow was greatly improved, assuming at this time, a form somewhat similar to the present; but it was still made almost entirely of wood. Such plows as these were used in Europe from the time of the Romans to the 18th century, in which the

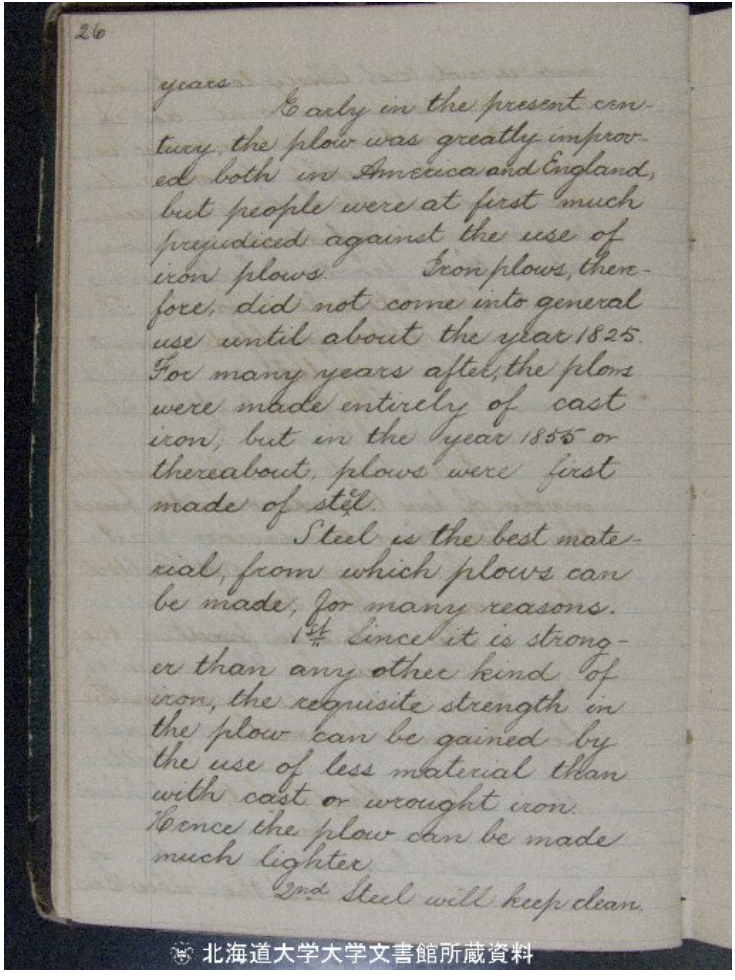


improvement of the plow in England was very decided. For a long time after this, however, plows were made mostly of wood. The first step in the improvement, was the fastening of strips of iron upon those parts which were most subjected to wear. The cast iron plow was first invented by James Small, an Englishman. The point of this plow was of wrought iron.

The first iron plows were made of two pieces, one the point the other the remaining parts.

In the year 1785, Robert Ransom, also an Englishman, invented the cast iron point.

A man by the name of Foljambe obtained a patent for a plow of peculiar shape, which was wound to be better than any other form; and plows of this kind were used for many years, not having gone out of use entirely till within about 40



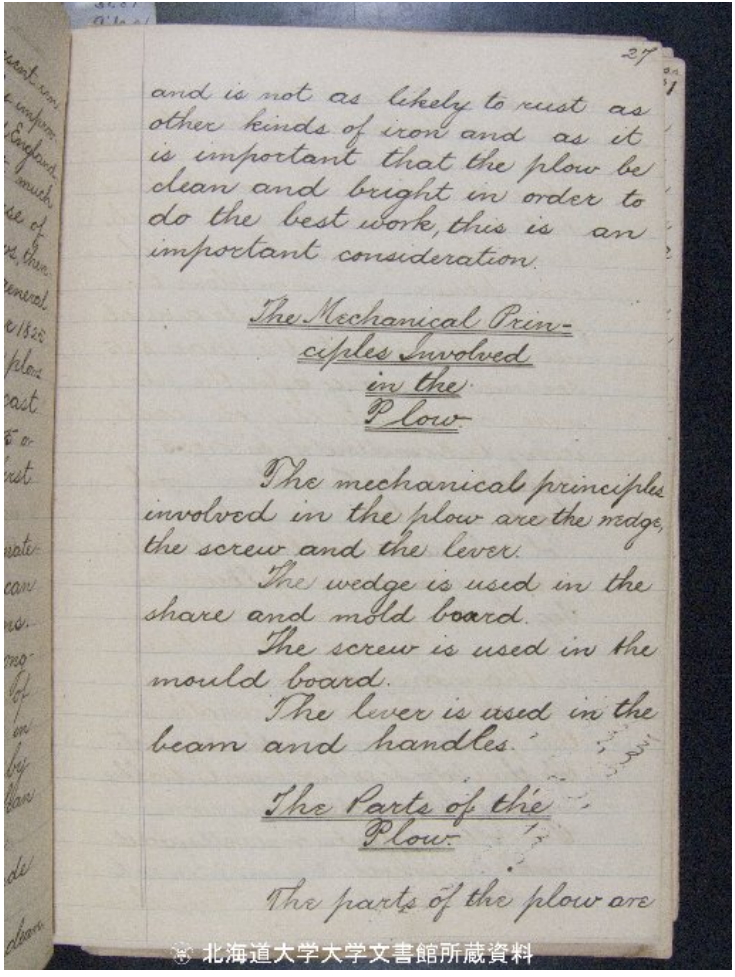
years.

Early in the present century, the plow was greatly improved both in America and England, but people were at first much prejudiced against the use of iron plows. Iron plows, therefore, did not come into general use until about the year 1825. For many years after, the plows were made entirely of cast iron; but in the year 1855 or thereabout, plows were first made of steel.

Steel is the best material, from which plows can be made, for many reasons.

1st Since it is stronger than any other kind of iron, the requisite strength in the plow can be gained by the use of less material than with cast or wrought iron. Hence the plow can be made much lighter.

2nd Steel will keep clean,



and is not as likely to rust as other kinds of iron and as it is important that the plow be clean and bright in order to do the best work, this is an important consideration.

The Mechanical Principles Involved in the Plow.

The mechanical principles involved in the plow are the wedge, the screw and the lever.

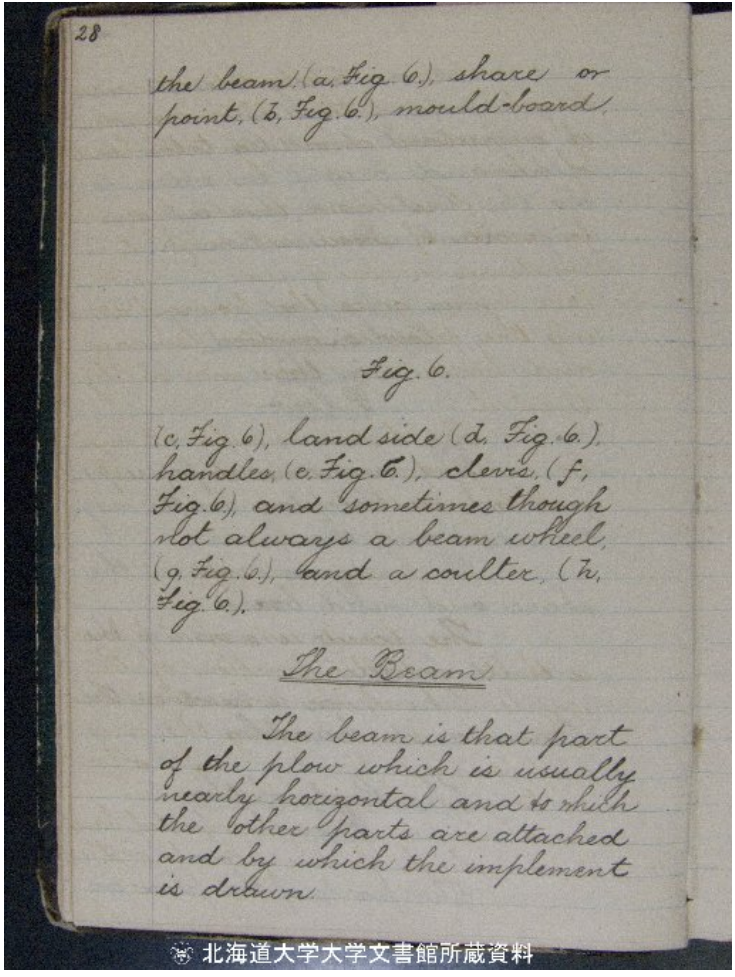
The wedge is used in the share and mold board.

The screw is used in the mould board.

The lever is used in the beam and handles.

The Parts of the Plow.

The parts of the plow are



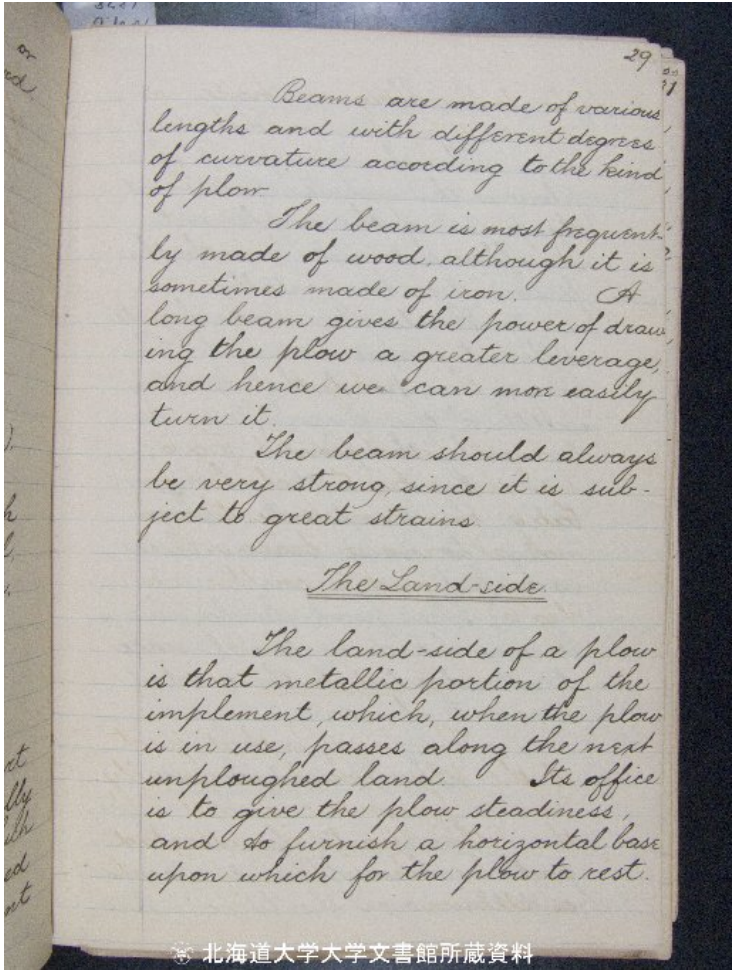
the beam, (a, Fig. 6.), share or point, (b, Fig. 6.), mould-board.

Fig.6.

(c, Fig.6.), land side (d, Fig. 6.), handles, (e, Fig. 6), clevis, (f, Fig. 6.), and sometimes though not always a beam wheel (g, Fig. 6.), and a coulter, (h, Fig. 6.).

The Beam.

The beam is that part of the plow which is usually nearly horizontal and to which the other parts are attached and by which the implement is drawn.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Beams are made of various lengths and with different degrees of curvature according to the kind of plow.

The beam is most frequently made of wood, although it is sometimes made of iron. A long beam gives the power of drawing the plow a greater leverage, and hence we can more easily turn it.

The beam should always be very strong, since it is subject to great strains.

The Land-side.

The land-side of a plow is that metallic portion of the implement, which, when the plow is in use, passes along the next unploughed land. Its office is to give the plow steadiness, and to furnish a horizontal base upon which for the plow to rest.

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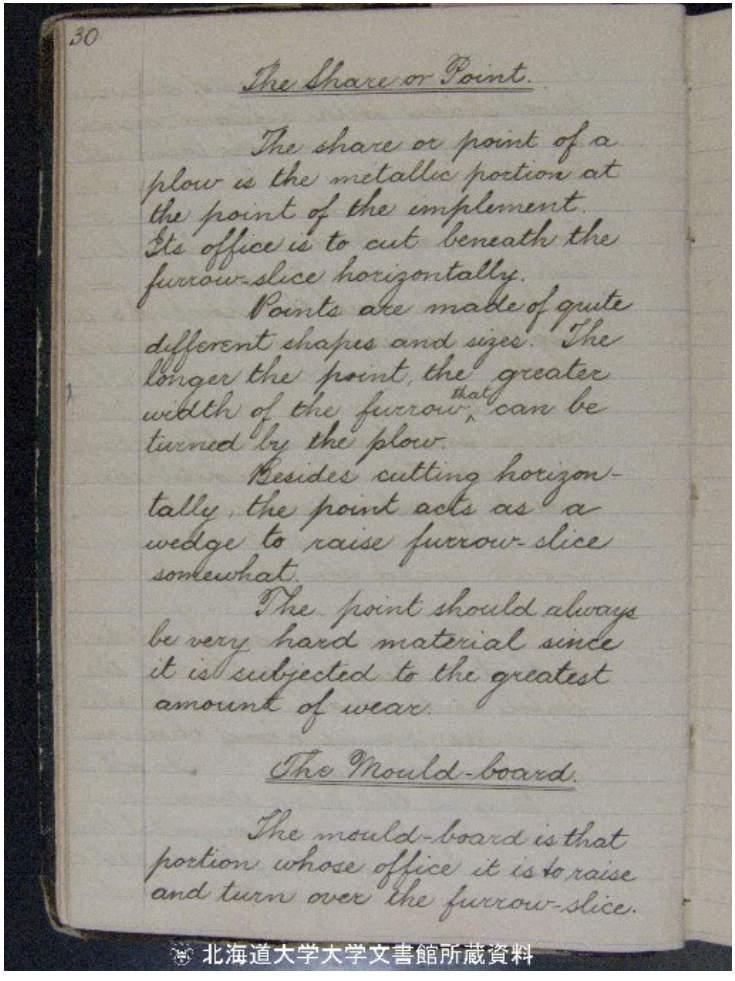


The Share or Point.

The share or point of a plow is the metallic portion at the point of the implement. Its office is to cut beneath the furrow-slice horizontally.

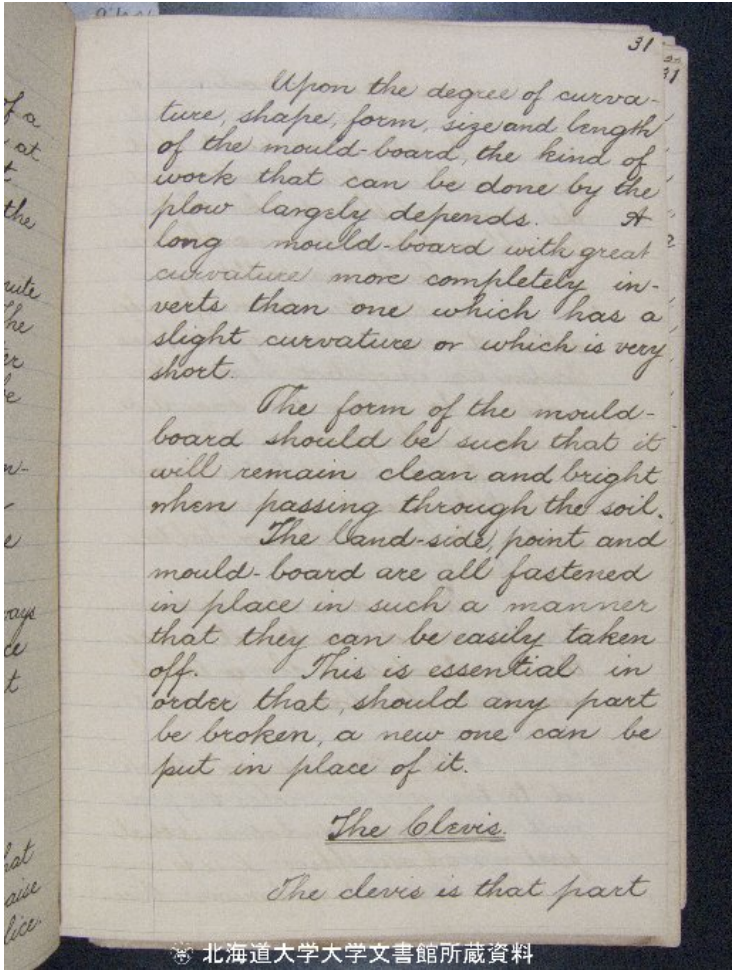
Points are made of quite different shapes and sizes. The longer the point, the greater width of the furrow that can be turned by the plow.

Besides cutting horizontally, the point acts as a wedge to raise furrow-slice somewhat.

The point should always be very hard material since it is subjected to the greatest amount of wear.

The Mould-board.

The mould-board is that portion whose office it is to raise and turn over the furrow-slice.



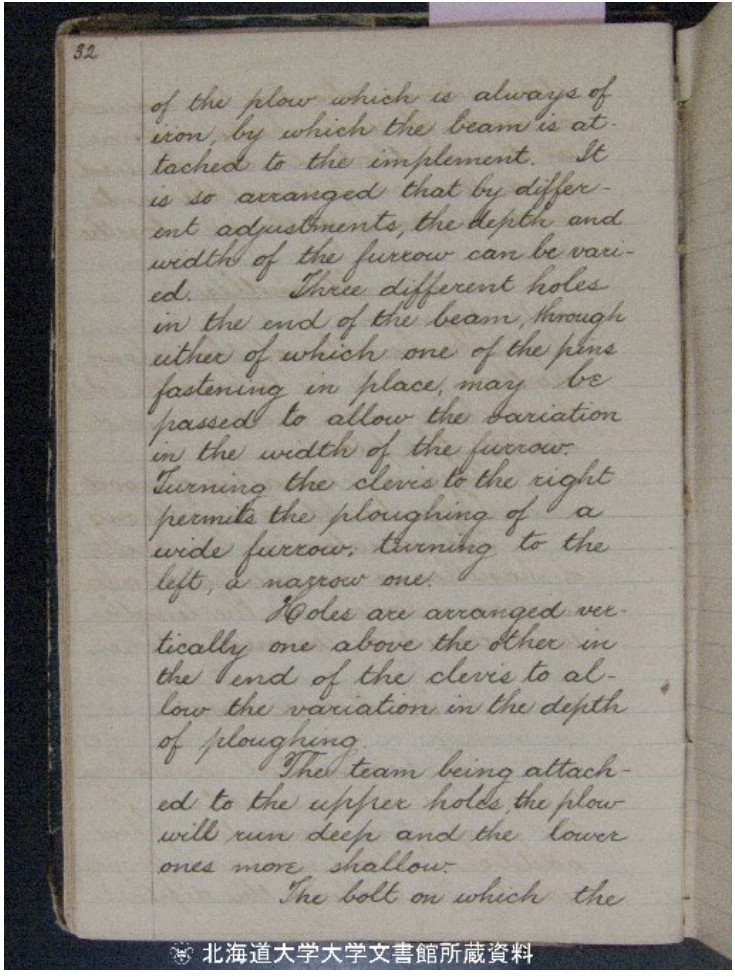
Upon the degree of curvature, shape, form, size and length of the mould-board, the kind of work that can be done by the plow largely depends. Along mould-board with great curvature more completely inverts than one which has a slight curvature or which is very short.

The form of the mould-board should be such that it will remain clean and bright when passing through the soil.

The land-side, point and mould-board are all fastened in place in such a manner that they can be easily taken off. This is essential in order that, should any part be broken, a new one can be put in place of it.

The Clevis.

The clevis is that part

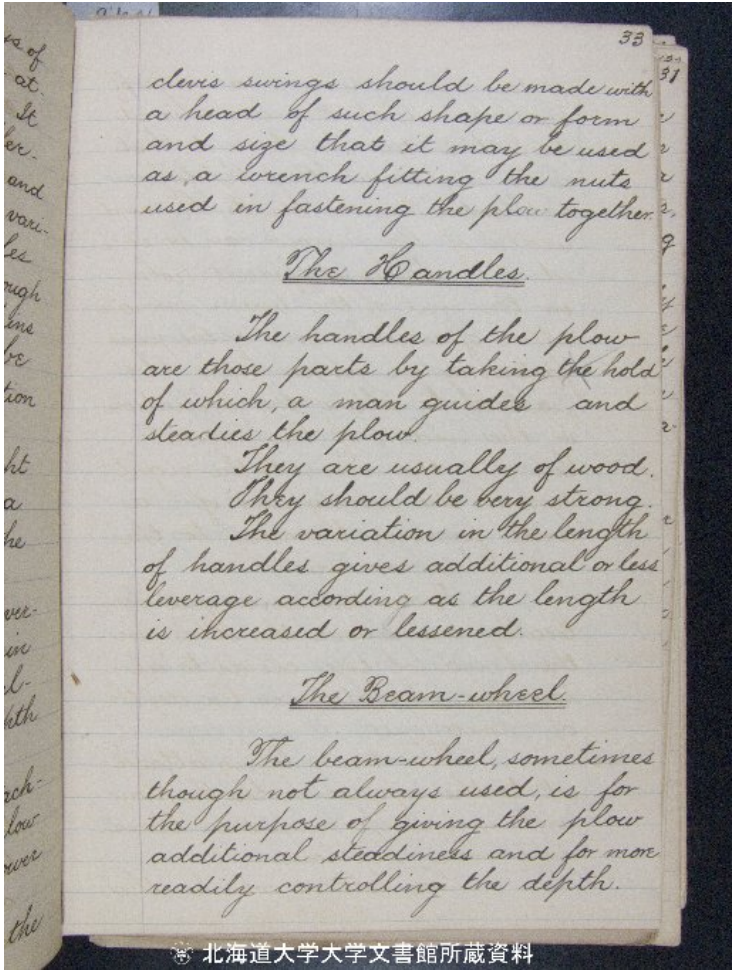


of the plow which is always of iron, by which the beam is attached to the implement. It is so arranged that by different adjustments, the depth and width of the furrow can be varied. Three different holes in the end of the beam, through either of which one of the pins fastening in place, may be passed to allow the variation in the width of the furrow. Turning the clevis to the right permits the ploughing of a wide furrow; twining to the left, a narrow one.

Holes are arranged vertically one above the other in the end of the clevis to allow the variation in the depth of ploughing.

The team being attached to the upper holes, the plow will run deep and the lower ones more shallow.

The bolt on which the



clevis swings should be made with a head of such shape or form and size that it may be used as a wrench fitting the nuts used in fastening the plow together.

The Handles.

The handles of the plow are those parts by taking hold of which, a man guides and steadies the plow.

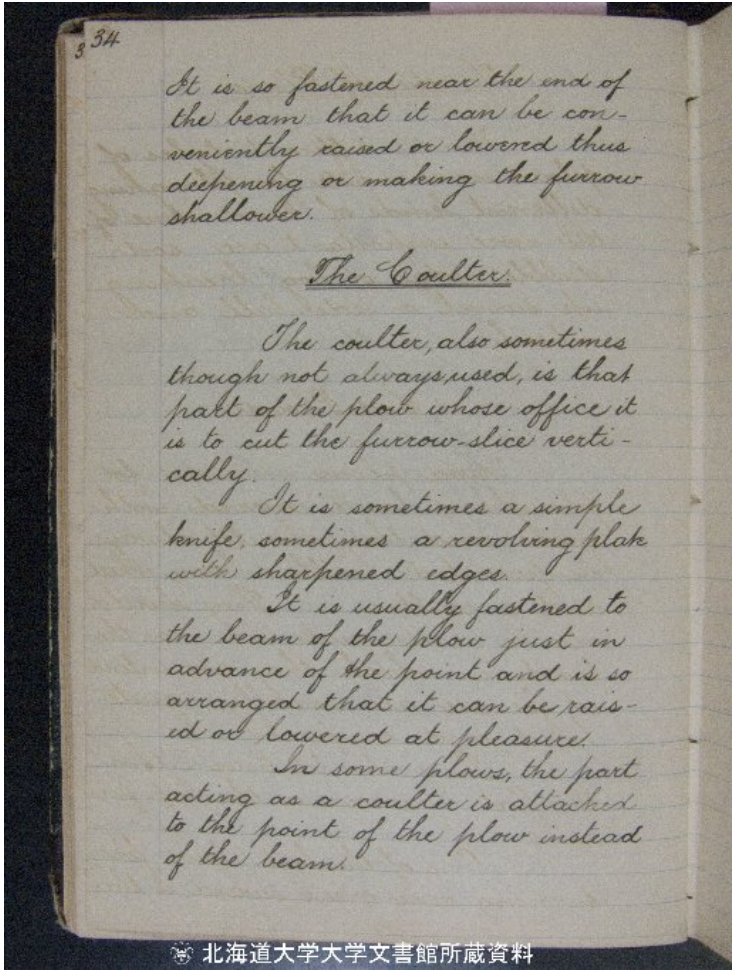
They are usually of wood.

They should be very strong.

The variation in the length of handles gives additional or less leverage according as the length is increased or lessened.

The Beam-wheel.

The beam-wheel, sometimes though not always used, is for the purpose of giving the plow additional steadiness and for more readily controlling the depth.



It is so fastened near the end of the beam that it can be conveniently raised or lowered thus deepening or making the furrow shallower.

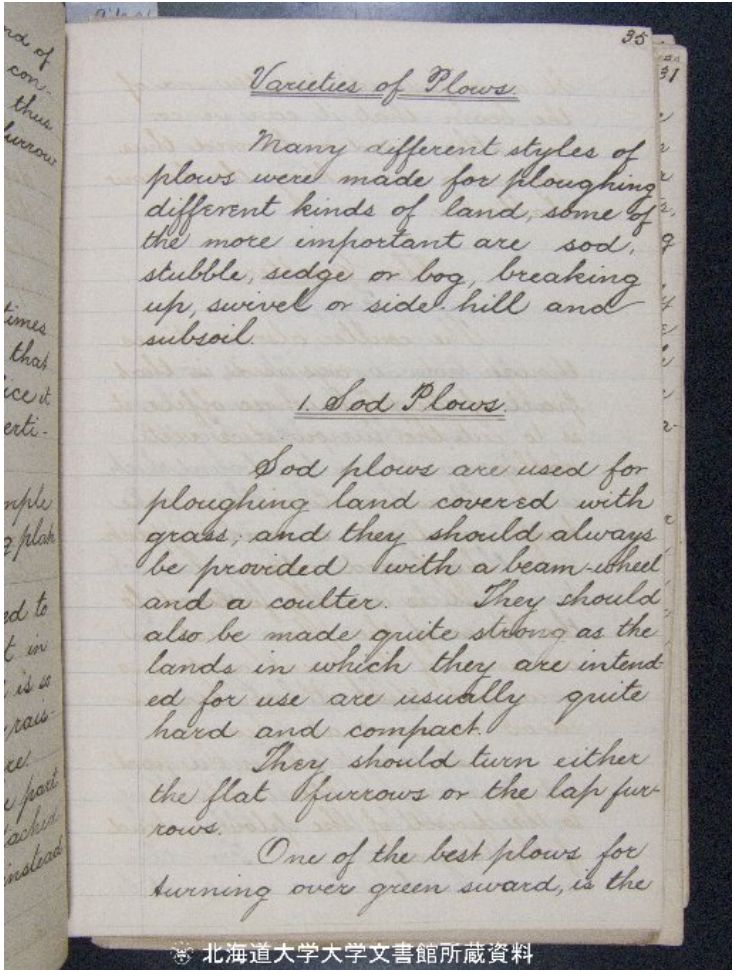
The Coulter.

The coulter, also sometimes though not always used, is that part of the plow whose office it is to cut the furrow-slice vertically.

It is sometimes a simple knife, sometimes a revolving plate with sharpened edges.

It is usually fastened to the beam of the plow just in advance of the point and is so arranged that it can be raised or lowered at pleasure.

In some plows, the part acting as a coulter is attached to the point of the plow instead of the beam.



Varieties of Plows.

Many different styles of plows were made for ploughing different kinds of land, some of the more important are sod, stubble, sedge or bog, breaking up, swivel or side-hill and subsoil.

1. Sod Plows.

Sod plows are used for ploughing land covered with grass; and they should always be provided with a beam-wheel and a coulter. They should also be made quite strong as the lands in which they are intended for use are usually quite hard and compact.

They should turn either the flat furrows or the lap furrows.

One of the best plows for twining over green sward, is the

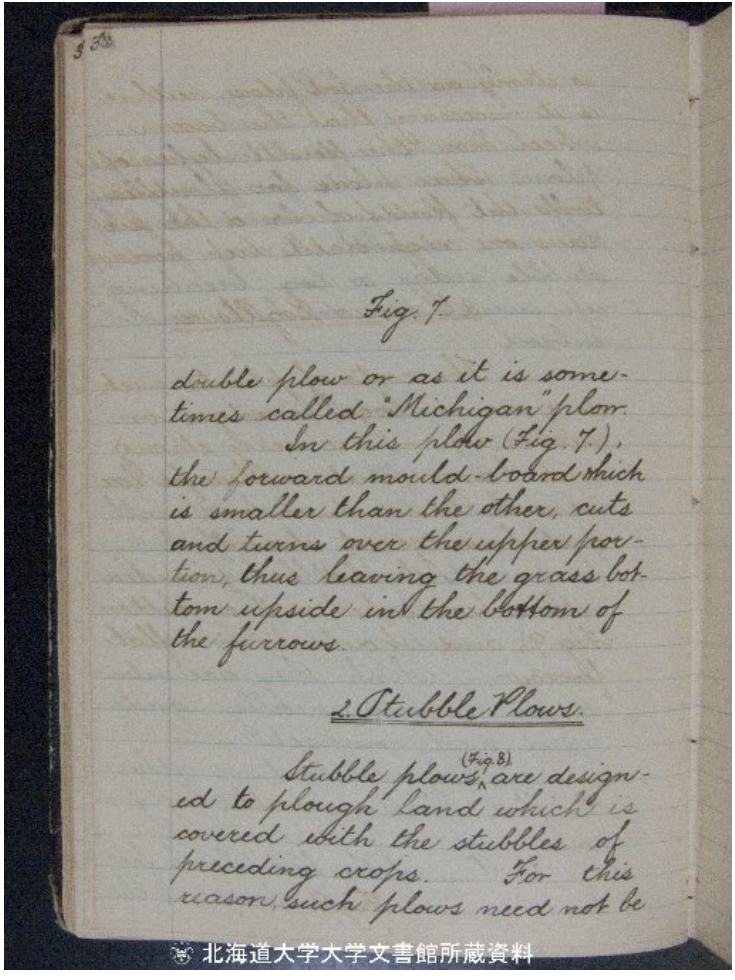


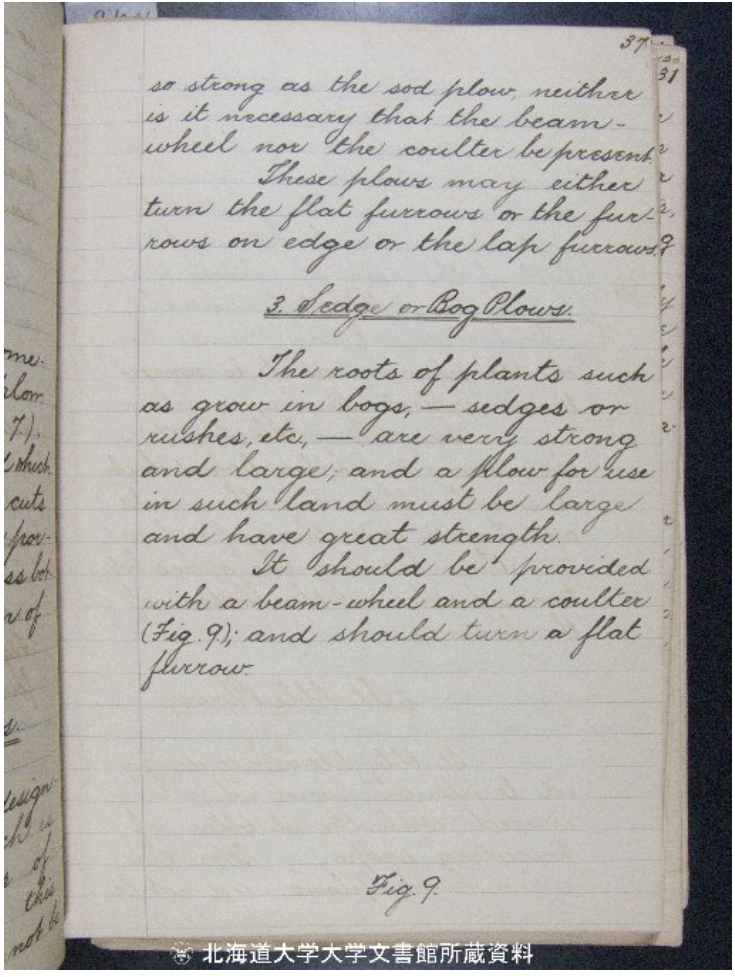
Fig. 7.

double plow or as it is some-times called “Michigan” plow.

In this plow (Fig. 7.), the forward mould-board which is smaller than the other, cuts and turns over the upper portion, thus leaving the grass bottom upside in the bottom of the furrows.

2. Stubble Plows.

Stubble plows (Fig. 8.), are designed to plough land which is covered with the stubbles of preceding crops. For this reason, such plows need not be



so strong as the sod plow, neither is it necessary that the beam-wheel nor the coulter be present.

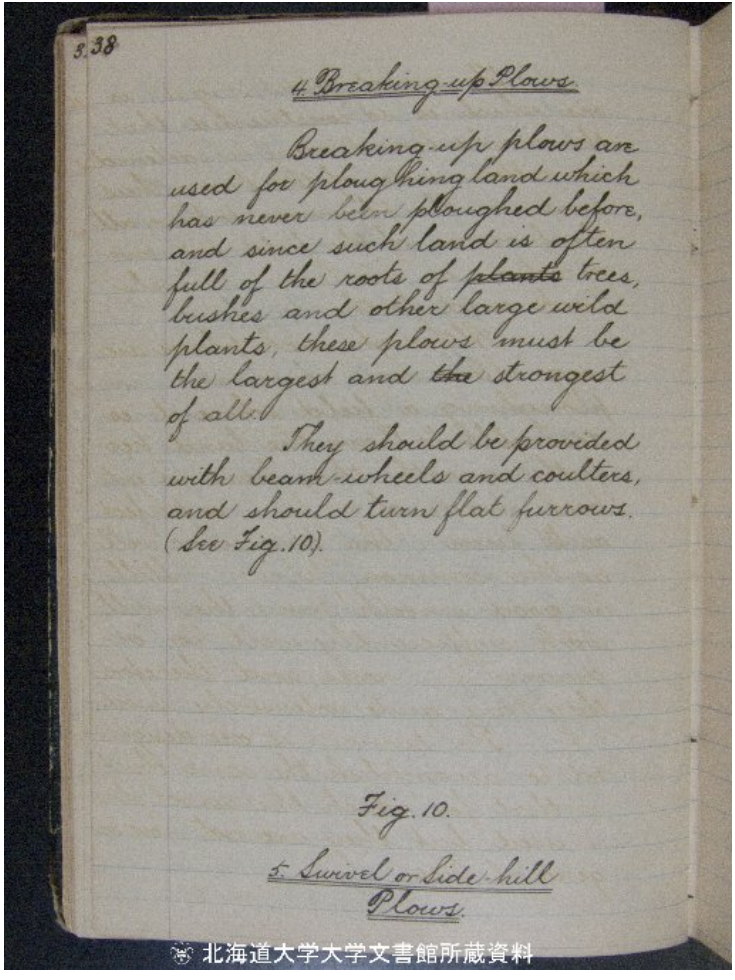
These plows may either turn the flat furrows or the furrows on edge or the lap furrows.

3. Sedge or Bog Plows.

The roots of plants such as grow in bogs, —— sedges or rushes, etc., —— are very strong and large; and a flow for use in such land must be large and have great strength.

It should be provided with a beam-wheel and a coulter (Fig. 9.); and should turn a flat furrow.

Fig. 9.



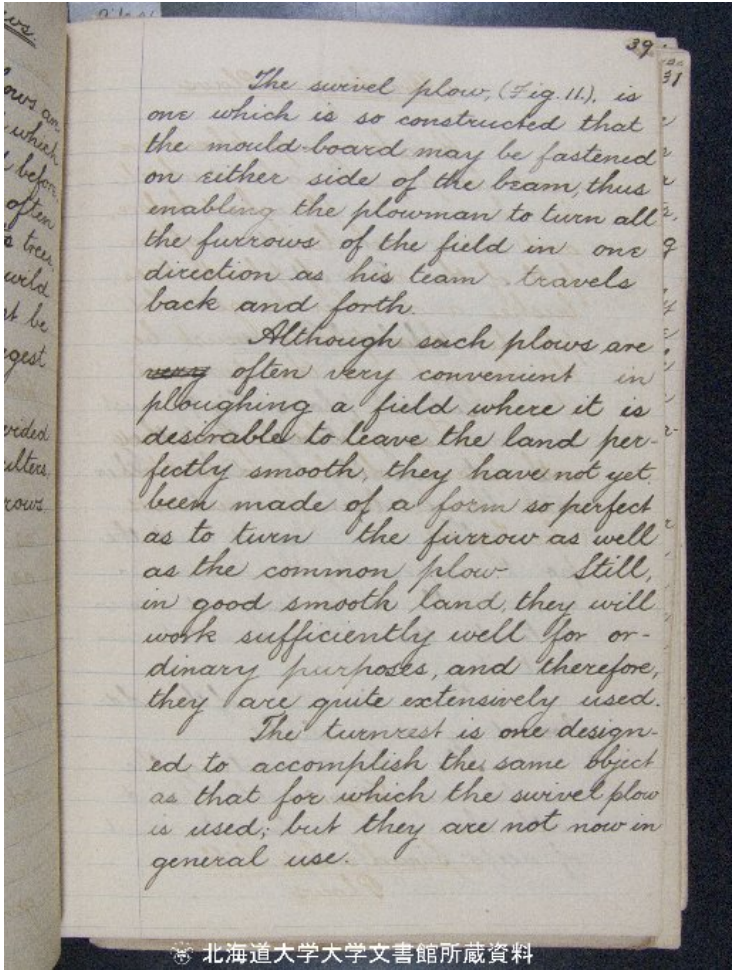
4. Breaking-up Plows.

Breaking-up plows are used for ploughing land which has never been ploughed before, and since such land is often full of the roots of trees, bushes and other large wild plants, these plows must be the largest and strongest of all.

They should be provided with beam-wheels and coulters, and should turn flat furrows. (See Fig. 10.).

Fig. 10.

5. Swivel or Side-hill Plows.



The swivel plow, (Fig. 11.), is one which is so constructed that the mould-board may be fastened on either side of the beam, thus enabling the plowman to turn all the furrows of the field in one direction as his team travels back and forth.

Although such plows are often very convenient in ploughing a field where it is descrable to leave the land perfectly smooth, they have not yet been made of a form so perfect as to turn the furrow as well as the common plow. Still in good smooth land, they will work sufficiently well for ordinary purposes, and therefore, they are quite extensively used.

The turnrest is one designed to accomplish the same object as that for which the swivel plow is used; but they are not now in general use.

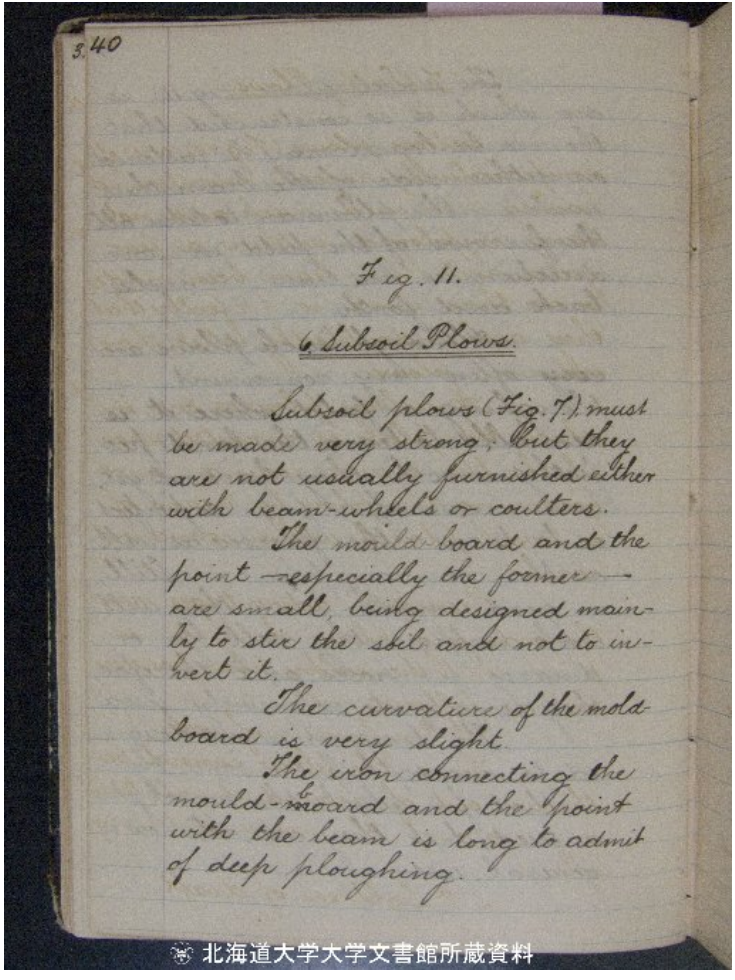


Fig. 11.

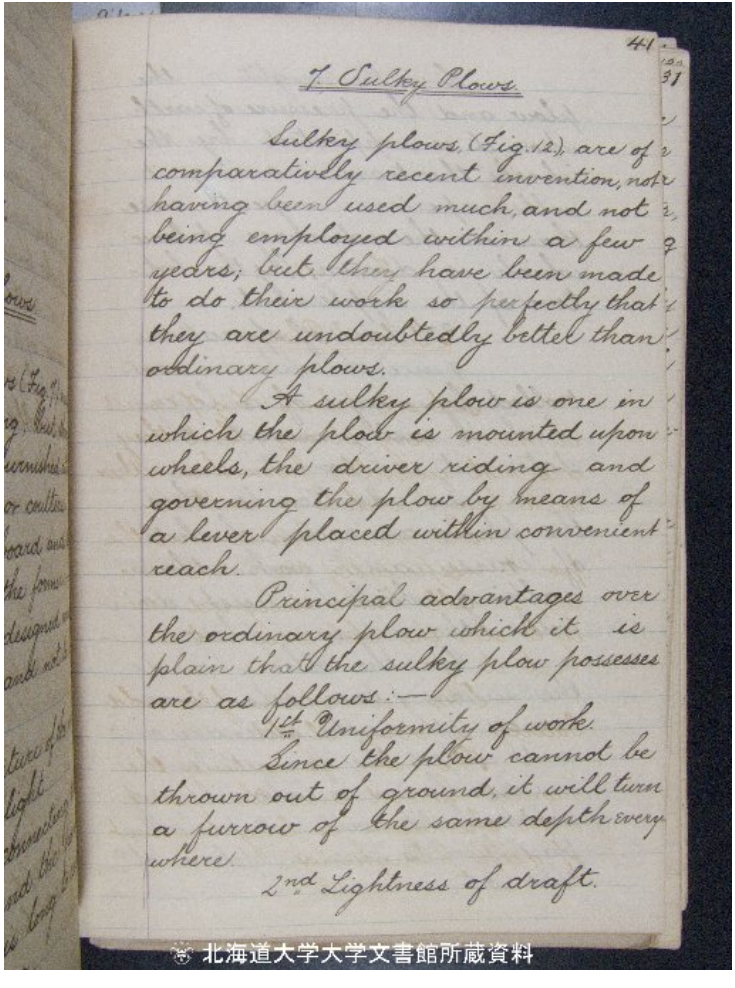
6. Subsoil Plows.

Subsoil plows (Fig. 7.), must be made very strong; but they are not usually furnished either with beam-wheels or coulters.

The mould-board and the point —— especially the former —— are small, being designed mainly to stir the soil and not to invert it.

The curvature of the mold-board is very slight.

The iron connecting the mould-board and the point with the beam is long to admit of deep ploughing.



7. Sulky Plows.

Sulky plows, (Fig. 12.), are of comparatively recent invention, not having been used much, and not being employed within a few years; but they have been made to do their work so perfectly that they are undoubtedly better than ordinary plows.

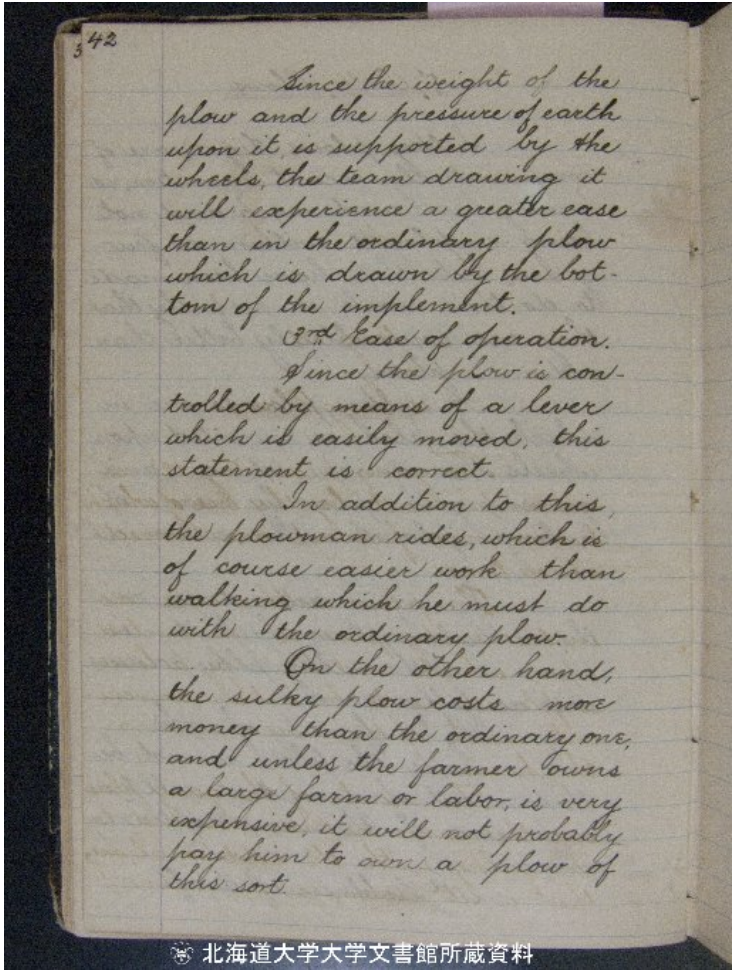
A sulky plow is one in which the plow is mounted upon wheels, the driver riding and governing the plow by means of a lever placed within convenient reach.

Principal advantages over the ordinary plow which it is plain that the sulky plow possesses are as follows: ——

1st Uniformity of work.

Since the plow cannot be thrown out of ground, it will turn a furrow of the same depth everywhere.

2nd Lightness of draft.



Since the weight of the plow and the pressure of earth upon it, is supported by the wheels, the team drawing it will experience a greater ease than in the ordinary plow which is drawn by the bottom of the implement.

3rd Ease of operation.

Since the plow is controlled by means of a lever which is easily moved, this statement is correct.

In addition to this, the plowman rides, which is of course easier work than walking which he must do with the ordinary plow.

On the other hand, the sulky plow costs more money than the ordinary one, and unless the farmer owns a large farm or labor, is very expensive, it will not probably pay him to own a plow of this sort.

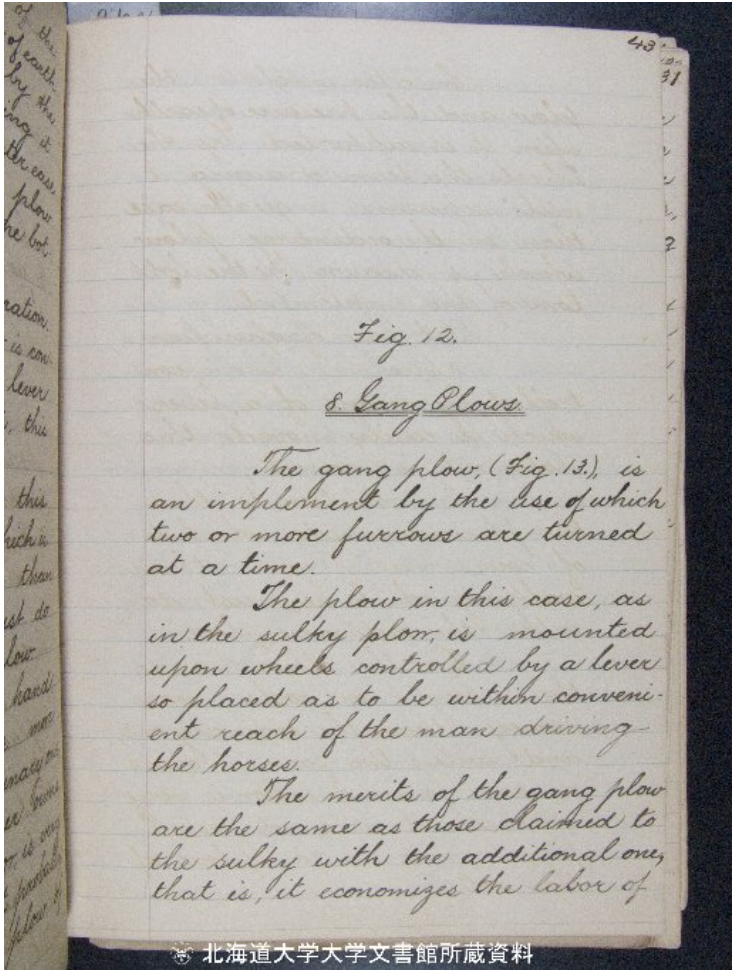


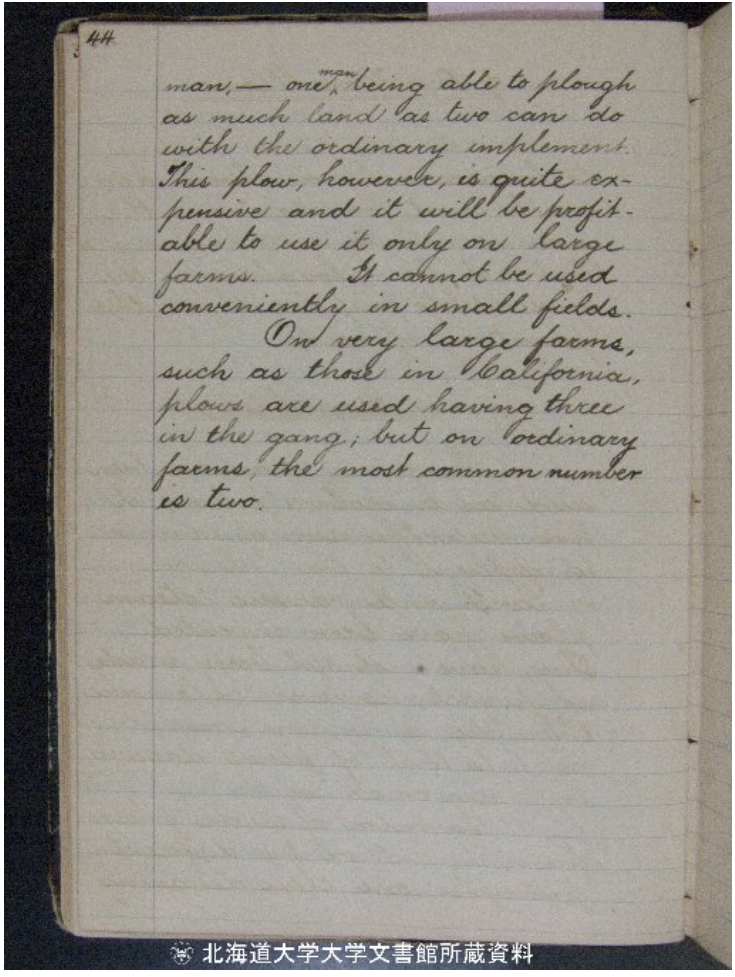
Fig. 12.

8. Gang Plows.

The gang plow, (Fig. 13.), is an implement by the use of which two or more furrows are turned at a time.

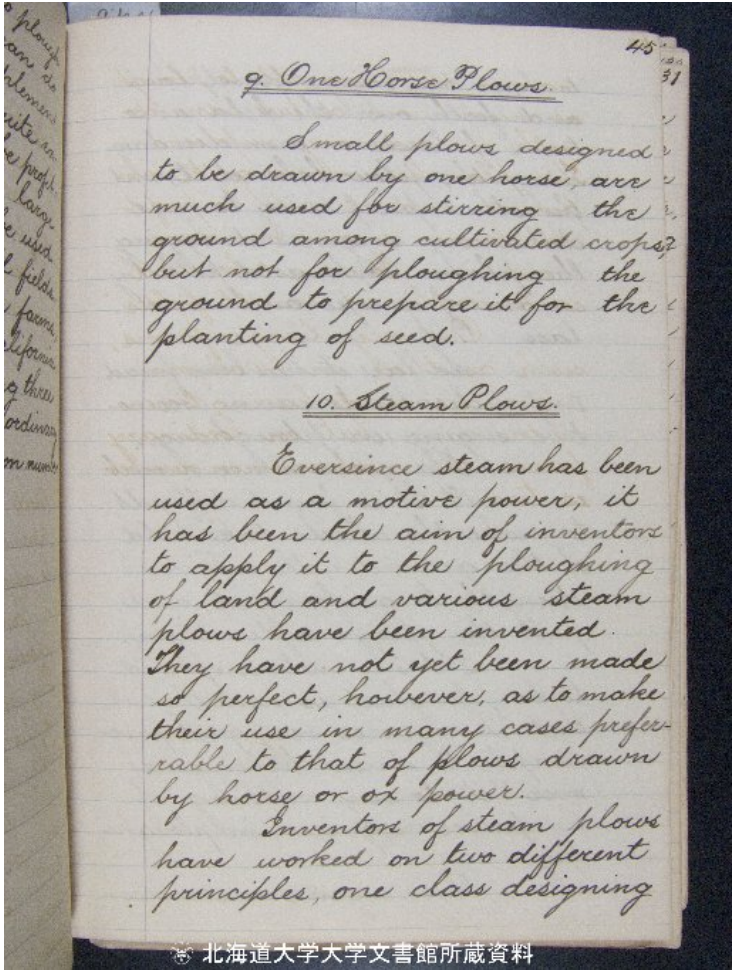
The plow in this case, as in the sulky plow, is mounted upon wheels controlled by a lever so placed as to be within convenient reach of the man driving the horses.

The merits of the gang plow are the same as those claimed to the sulky with the additional one, that is, it economizes the labor of



man. —— one man being able to plough as much land as two can do with the ordinary implement. This plow, however, is quite expensive and it will be profitable to use it only on large farms. It cannot be used conveniently in small fields.

On very large farms, such as those in California, plows are used having three in the gang; but on ordinary farms, the most common number is two.



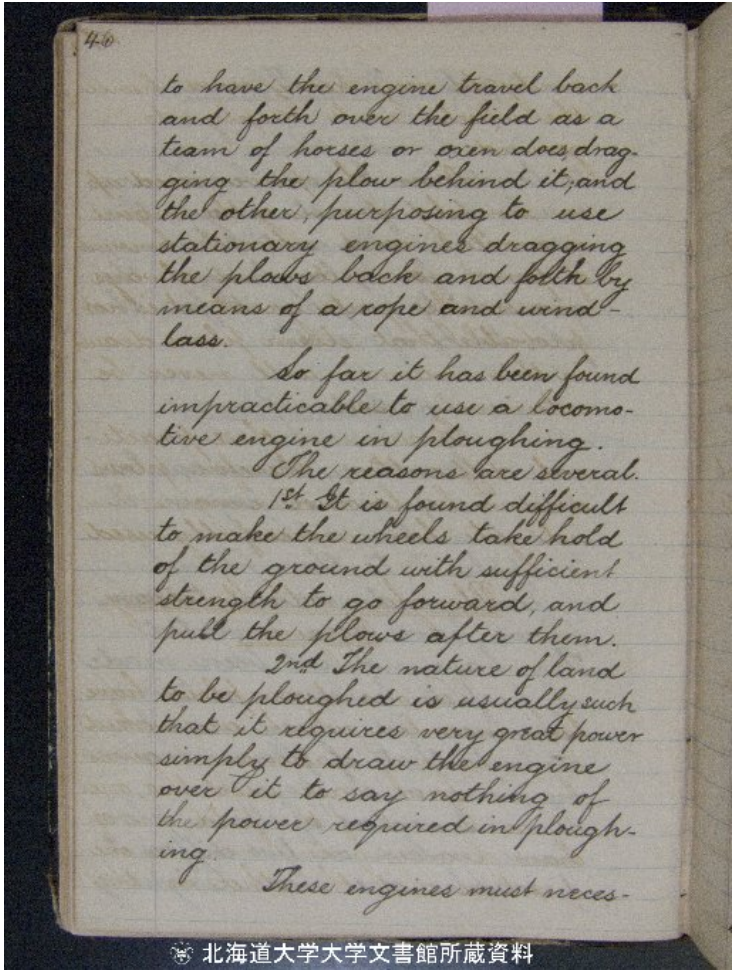
9. One Horse Plows.

Small plows designed to be drawn by one horse are much used for stirring the ground among cultivated crops, but not for ploughing the ground to prepare it for the planting of seed.

10. Steam Plows.

Eversince steam has been used as a motive power, it has been the aim of inventors to apply it to the ploughing of land and various steam plows have been invented. They have not yet been made so perfect, however, as to make their use in many cases preferrable to that of plows drawn by horse or ox power.

Inventors of steam plows have worked on two different principles, one class designing



to have the engine travel back and forth over the field as a team of horses or oxen does, dragging the plow behind it; and the other, purposing to use stationary engines dragging the plows back and forth by means of a rope and windlass.

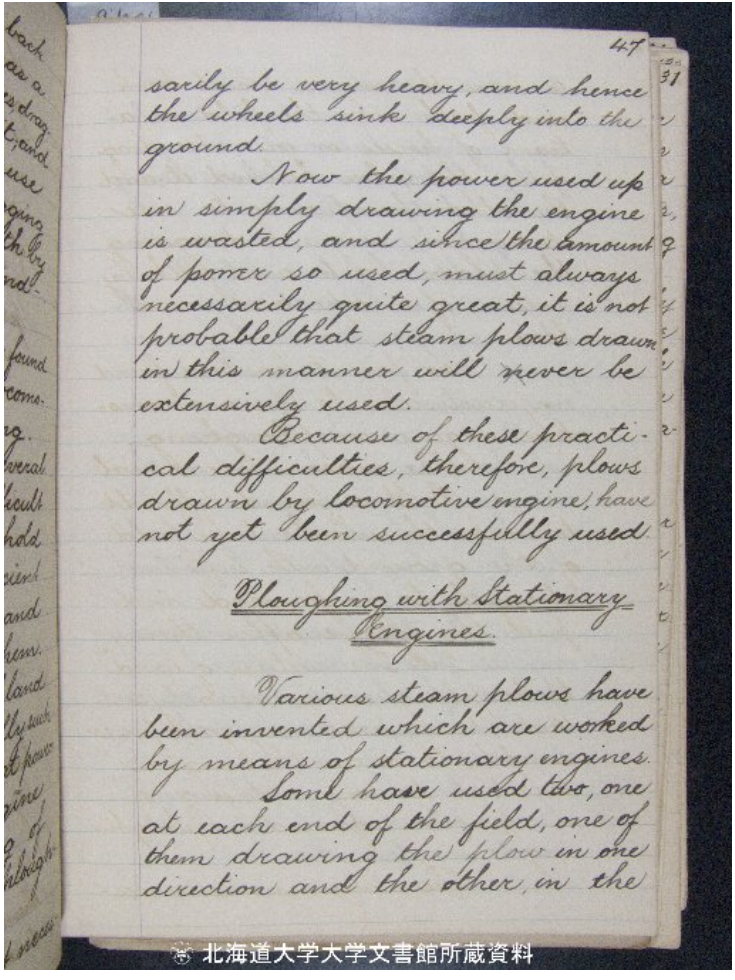
So far it has been found impracticable to use a locomotive engine in ploughing.

The reasons are several.

1st It is found difficult to make the wheels take hold of the ground with sufficient strength to go forward, and pull the plows after them.

2nd The nature of land to be ploughed is usually such that it requires very great power simply to draw the engine over it to say nothing of the power required in ploughing.

These engines must necessarily



be very heavy, and hence the wheels sink deeply into the ground.

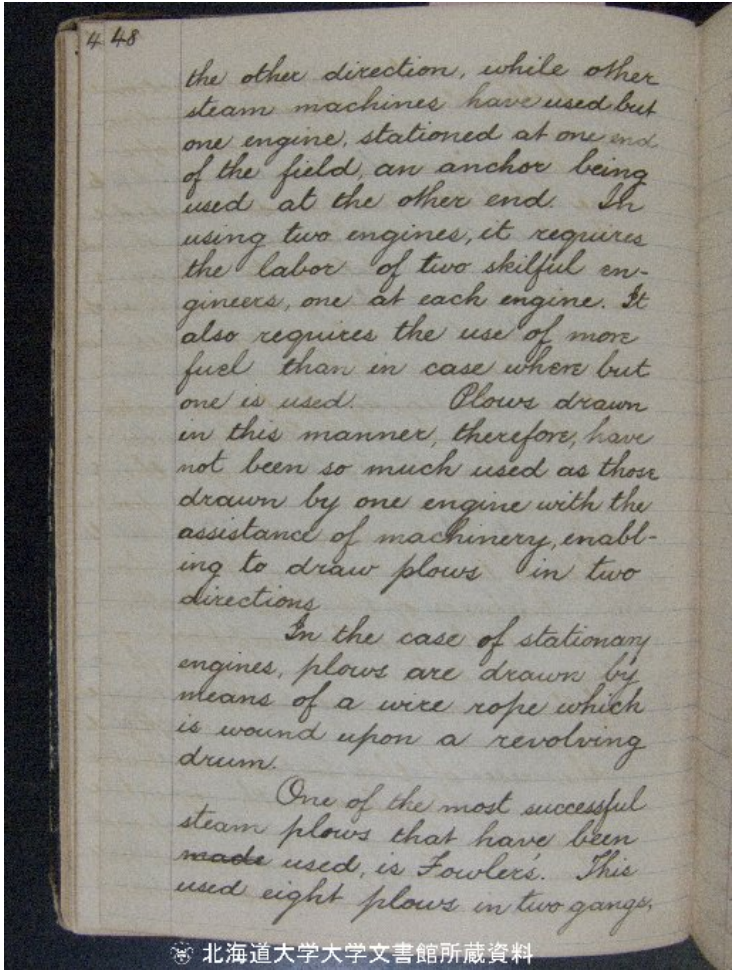
Now the power used up in simply drawing the engine is wasted, and since the amount of power so used, must always necessarily quite great, it is not probable that steam plows drawn in this manner will ever be extensively used.

Because of these practical difficulties, therefore, plows drawn by locomotive engine, have not yet been successfully used.

Ploughing with Stationary Engines.

Various steam plows have been invented which are worked by means of stationary engines.

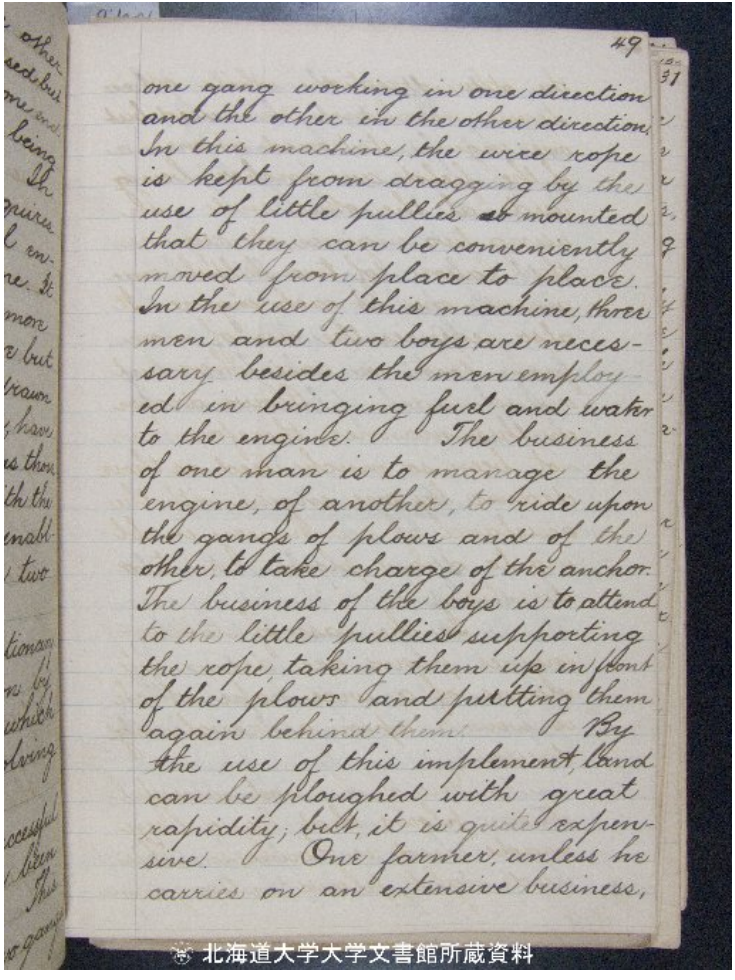
Some have used two, one at each end of the field, one of them drawing the plow in one direction and the other, in the



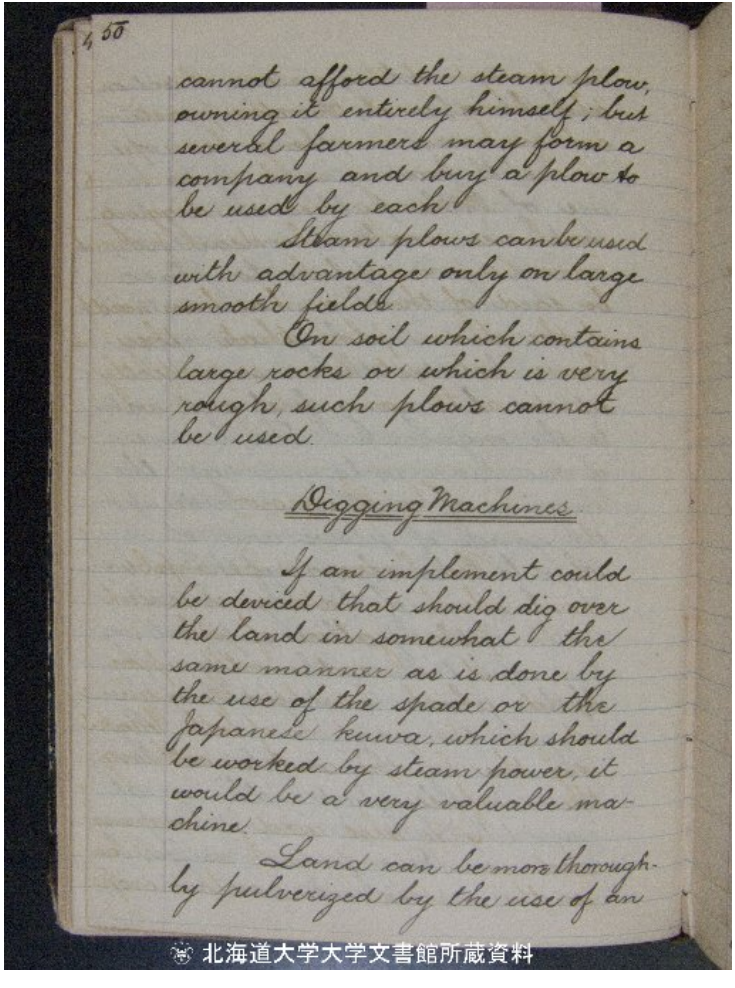
other direction, while other steam machines have used but one engine, stationed at one end of the field, an anchor being used at the other end. In using two engines, it requires the labor of two skilful engineers, one at each engine. It also requires the use of more fuel than in case where but one is used. Plows drawn in this manner, therefore, have not been so much used as those drawn by one engine with the assistance of machinery, enabling to draw plows in two directions.

In the case of stationary engines, plows are drawn by means of a wire rope which is wound upon a revolving drum.

One of the most successful steam plows that have been used, is Fowler's. This used eight plows in two gangs,



one gang working in one direction and the other in the other direction. In this machine, the wire rope is kept from dragging by the use of little pullies so mounted that they can be conveniently moved from place to place. In the use of this machine, there men and two boys are necessary besides the men employed in bringing fuel and water to the engine. The business of one man is to manage the engine, of another, to ride upon the gangs of plows and of the other, to take charge of the anchor. The business of the boys is to attend to the little pullies supporting the rope, taking them up in front of the plows and putting them again behind them. By the use of this implement, land can be ploughed with great rapidity; but, it is quite expensive. One farmer, unless he carries on an extensive business,



cannot afford the steam plow, owning it entirely himself; but several farmers may form a company and buy a plow to be used by each.

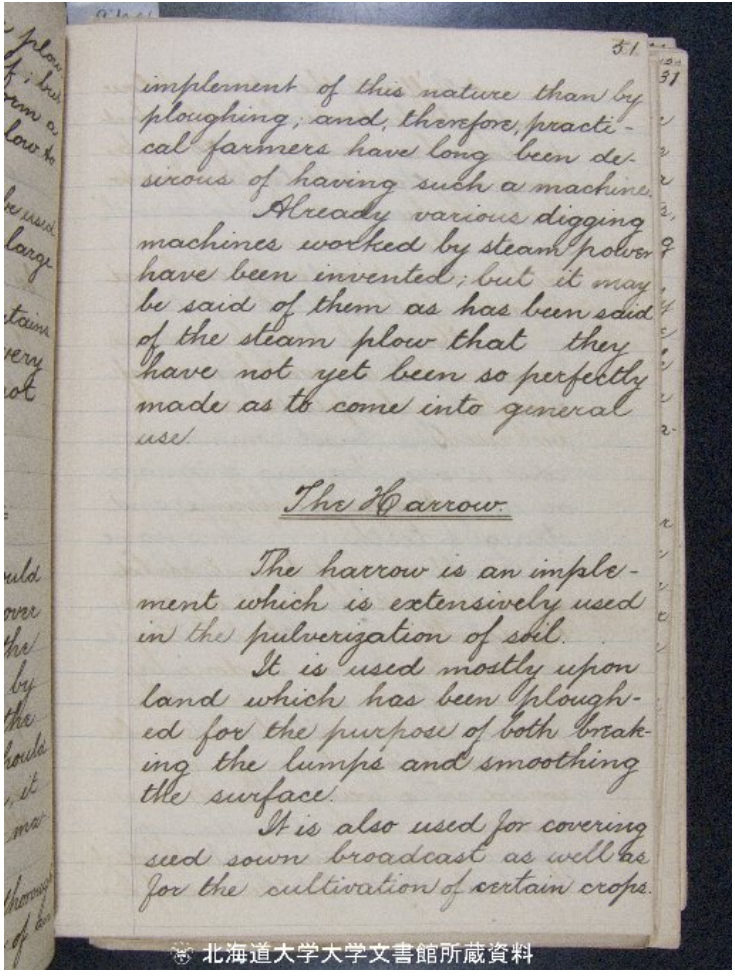
Steam plows can be used with advantage only on large smooth fields.

On soil which contains large rocks or which is very rough, such plows cannot be used.

Digging Machines.

If an implement could be deviced that should dig over the land in somewhat the same manner as is done by the use of the spade or the Japanese kuwa, which should be worked by steam power, it would be a very valuable machine.

Land can be more thoroughly pulverized by the use of an



implement of this nature than by ploughing; and, therefore, practical farmers have long been desirous of having such a machine.

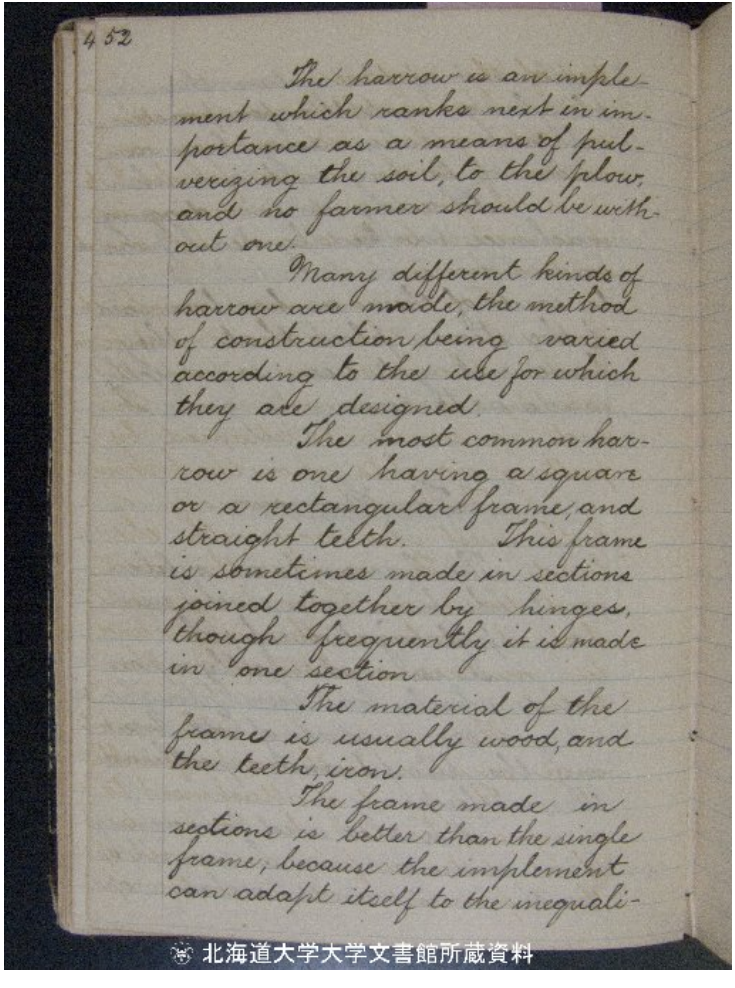
Already various digging machines worked by steam power have been invented; but it may be said of them as has been said of the steam plow that they have not yet been so perfectly made as to come into general use.

The Harrow.

The harrow is an implement which is extensively used in the pulverization of soil.

It is used mostly upon land which has been ploughed for the purpose of both breaking the lumps and smoothing the surface.

It is also used for covering seed sown broadcast as well as for the cultivation of certain crops.



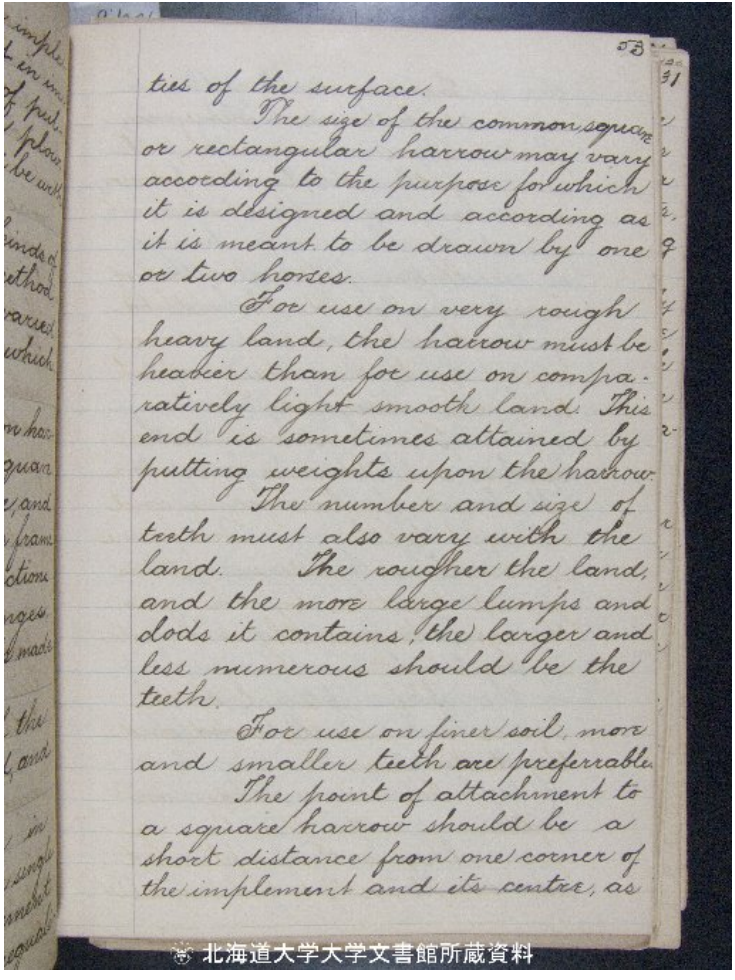
The harrow is an implement which ranks next in importance as a means of pulverizing the soil, to the plow, and no farmer should be without one.

Many different kinds of harrow are wade, the method of construction being varied according to the use for which they are designed.

The most common harrow is one having a square or a rectangular frame, and straight teeth. This frame is sometimes made in sections joined together by hinges, though frequently it is made in one section.

The material of the frame is usually wood, and the teeth, iron.

The frame made in sections is better than the single frame; because the implement can adapt itself to the inequalities



of the surface.

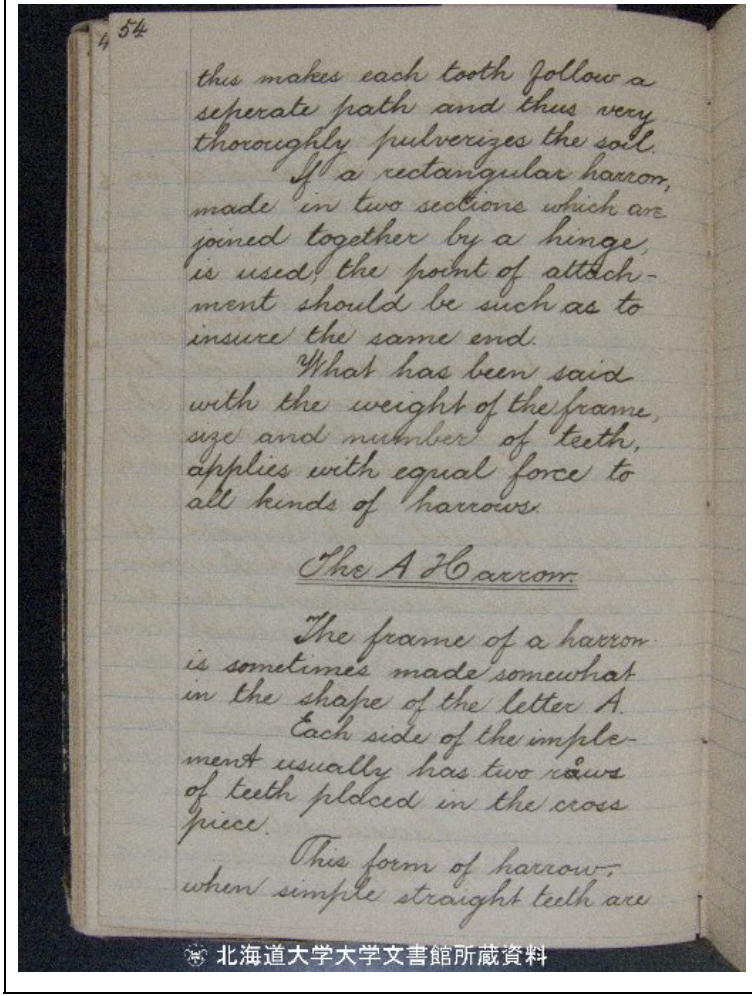
The size of the common square or rectangular harrow may vary according to the purpose for which it is designed and according as it is meant to be drawn by one or two horses.

For use on very rough heavy land, the harrow must be heavier than for use on comparatively light smooth land. This end is sometimes attained by putting weights upon the harrow.

The number and size of teeth must also vary with the land. The rougher the land, and the more large lumps and clods it contains, the larger and less numerous should be the teeth.

For use on finer soil, more and smaller teeth are preferrable.

The point of attachment to a square harrow should be a short distance from one corner of the implement and its centre, as



this makes each tooth follow a seperate path and thus very thoroughly pulverizes the soil.

If a rectangular harrow, made in two sections which are joined together by a hinge, is used, the point of attachment should be such as to insure the same end.

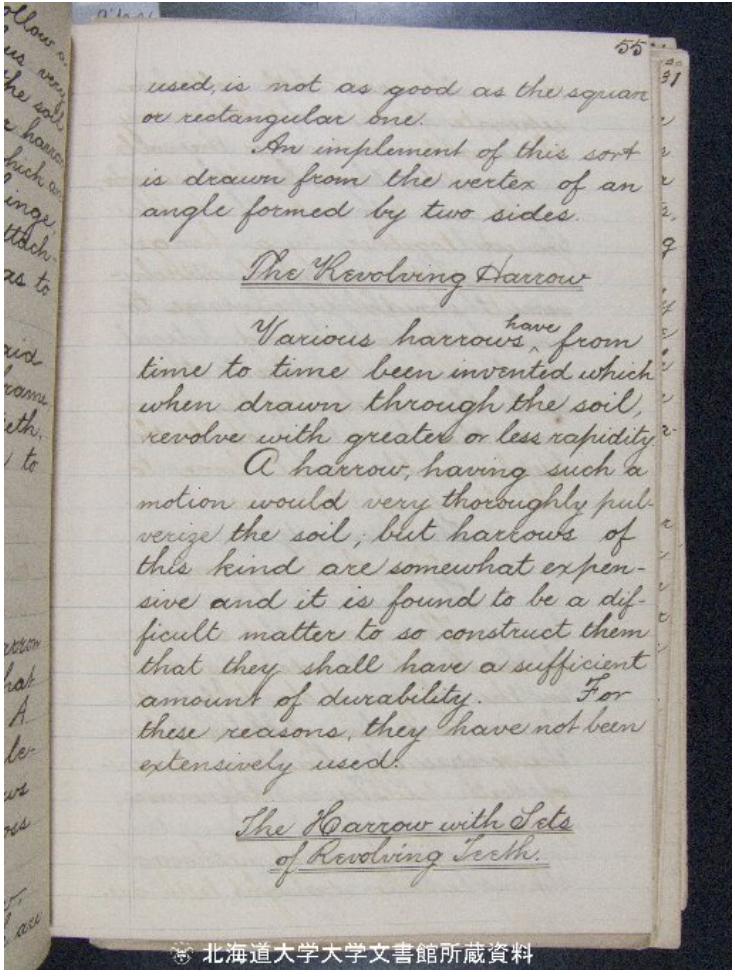
What has been said with the weight of the frame, size and number of teeth, applies with equal force to all kinds of harrows.

The A Harrow.

The frame of a harrow is sometimes made somewhat in the shape of the letter A.

Each side of the implement usually has two rows of teeth placed in the cross piece.

This form of harrow, when simple straight teeth are



used, is not as good as the square or rectangular one.

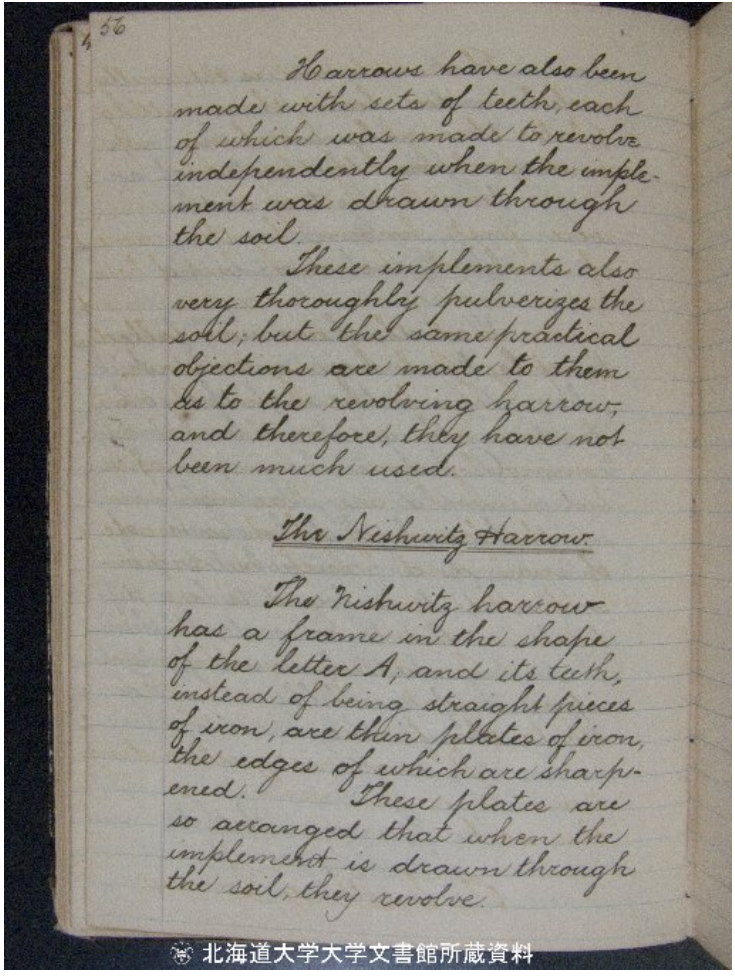
An implement of this sort is drawn from the vertex of an angle formed by two sides.

The Revolving Harrow.

Various harrows have from time to time been invented which when drawn through the soil, revolve with greater or less rapidity.

A harrow, having such a motion would very thoroughly pulverize the soil; but harrows of this kind are somewhat expensive and it is found to be a difficult matter to so construct them that they shall gave a sufficient amount of durability. For these reasons, they have not been extensively used.

The Harrow with Lets
of Revolving Teeth.

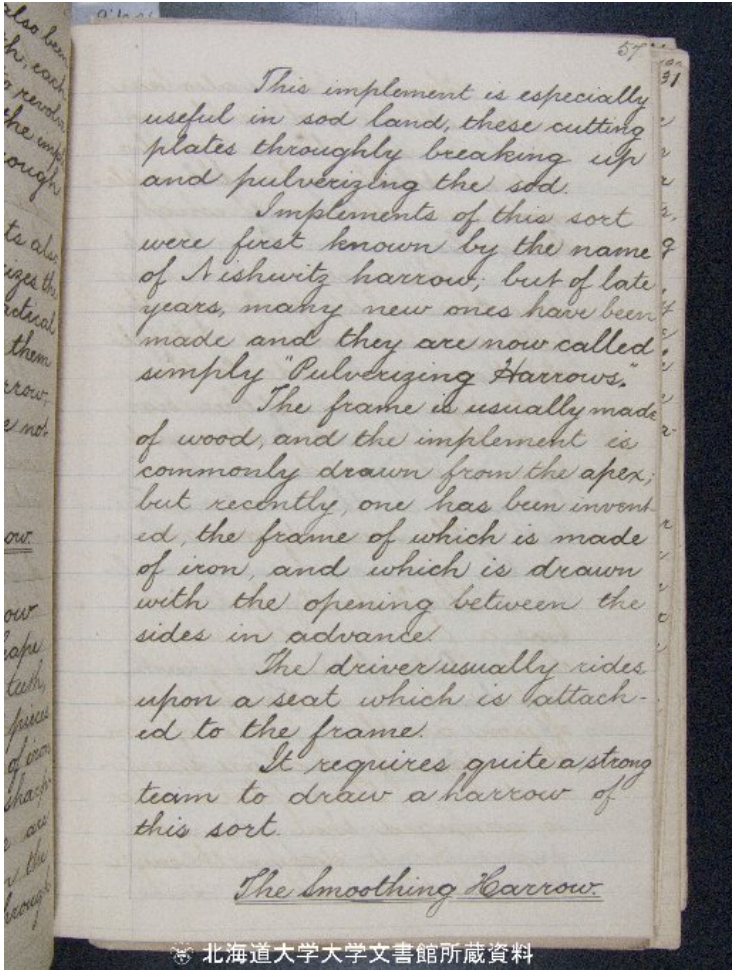


Harrows have also been made with sets of teeth, each of which was made to revolve independently when the implement was drawn through the soil.

These implements also very thoroughly pulverizes the soil; but the same practical objections are made to them as to the revolving harrow, and therefore, they have not been much used.

The Nishwitz Harrow.

The Nishwitz harrow has a frame in the shape of the letter A; and its teeth, instead of being straight pieces of iron, are thin plates of iron, the edges of which are sharpened. These plates are so arranged that when the implement is drawn through the soil, they revolve.



This implement is especially useful in sod land, these cutting plates throughly breaking up and pulverizing the sod.

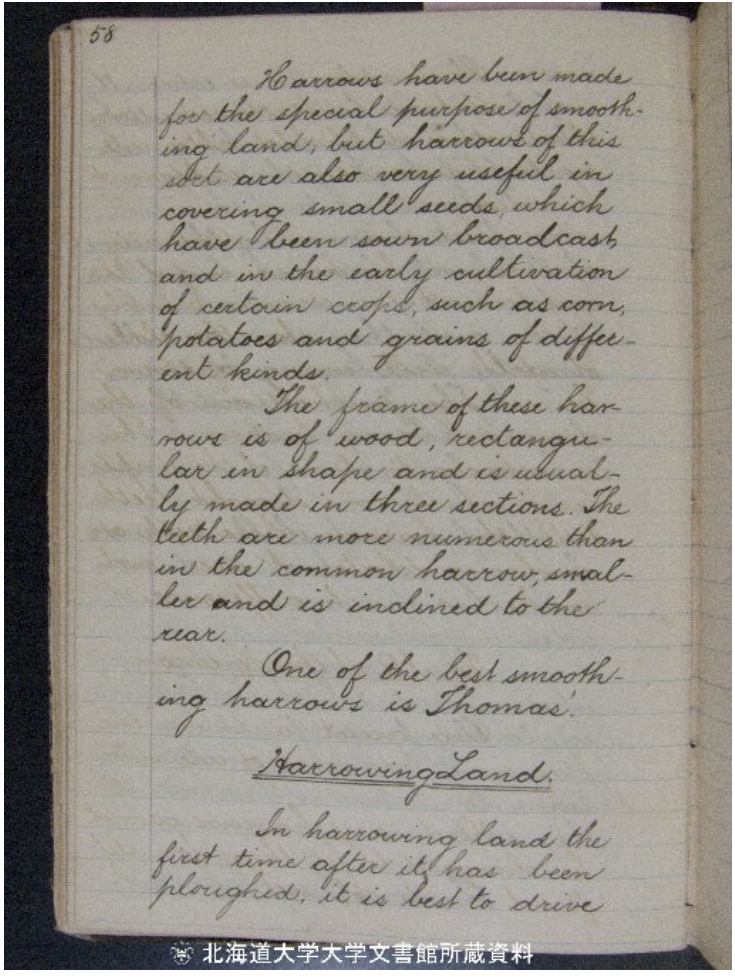
Implements of this sort were first known by the name of Nishwitz harrow, but of late years, many new ones have been made and they are now called simply "Pulverizing Harrows."

The frame is usually made of wood, and the implement is commonly drawn from the apex; but recently, one has been invented, the frame of which is made of iron, and which is drawn with the opening between the sides in advance.

The driver usually rides upon a seat which is attacked to the frame.

It requires quite a strong team to draw a harrow of this sort.

The Smoothing Harrow.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Harrows have been made for the special purpose of smoothing land, but harrows of this sort are also very useful in covering small seeds, which have been sown broadcast, and in the early cultivation of certain crops, such as corn, potatoes and grains of different kinds.

The frame of these harrows is of wood, rectangular in shape and is usually made in three sections. The teeth are more numerous than in the common harrow, smaller and is inclined to the rear.

One of the best smoothing harrows is Thomas'.

Harrowing Land.

In harrowing land the first time after it has been ploughed, it is best to drive

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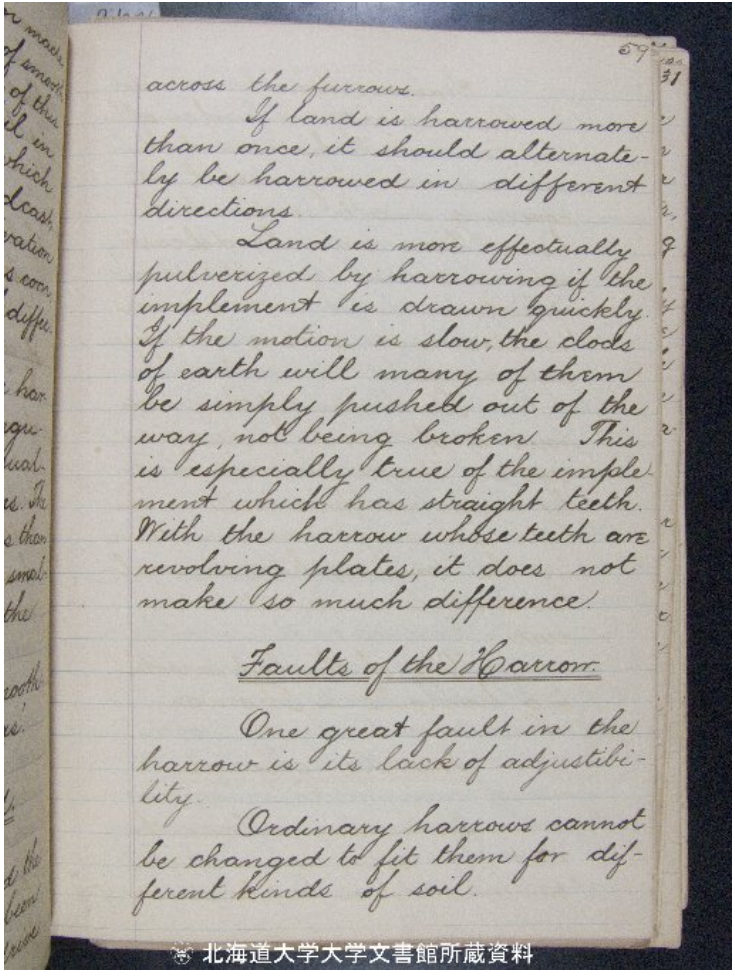


across the furrows.

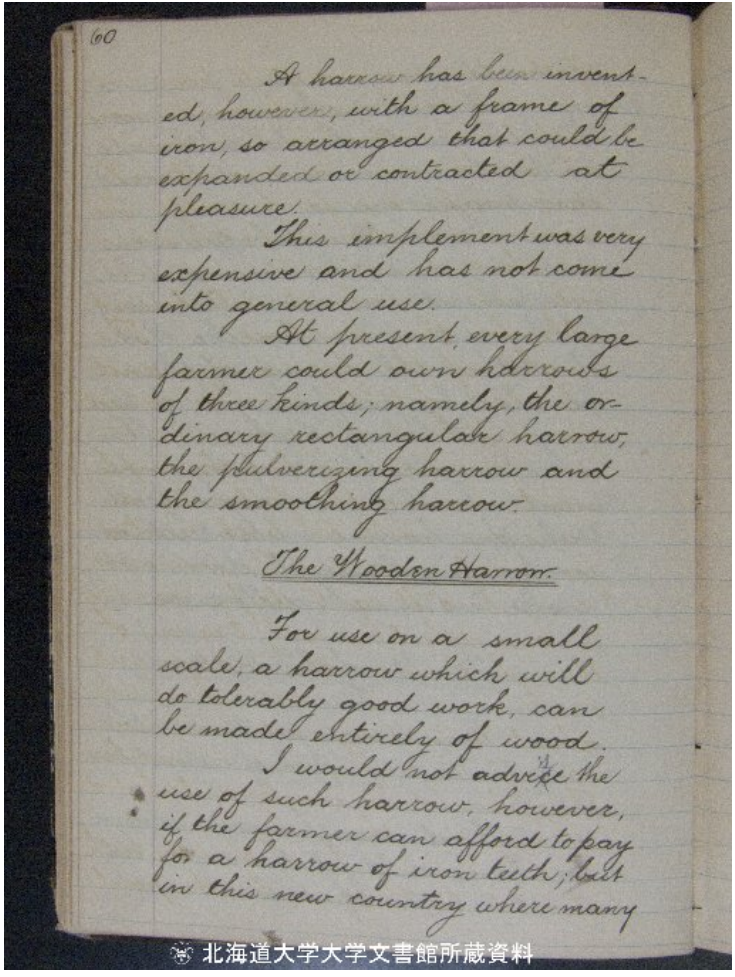
If land is harrowed more than once, it should alternately be harrowed in different directions.

Land is more effectually pulverized by harrowing if the implement is drawn quickly. If the motion is slow, the clods of earth will many of them be simply pushed out of the way, not being broken. This is especially true of the implement which has straight teeth. With the harrow whose teeth are revolving plates, it does not make so much difference.

Faults of the Harrow.

One great fault in the harrow is its lack of adjustibility.

Ordinary harrows cannot be changed to fit them for different kinds of soil.



A harrow has been invented, however, with a frame of iron, so arranged that could be expanded or contracted at pleasure.

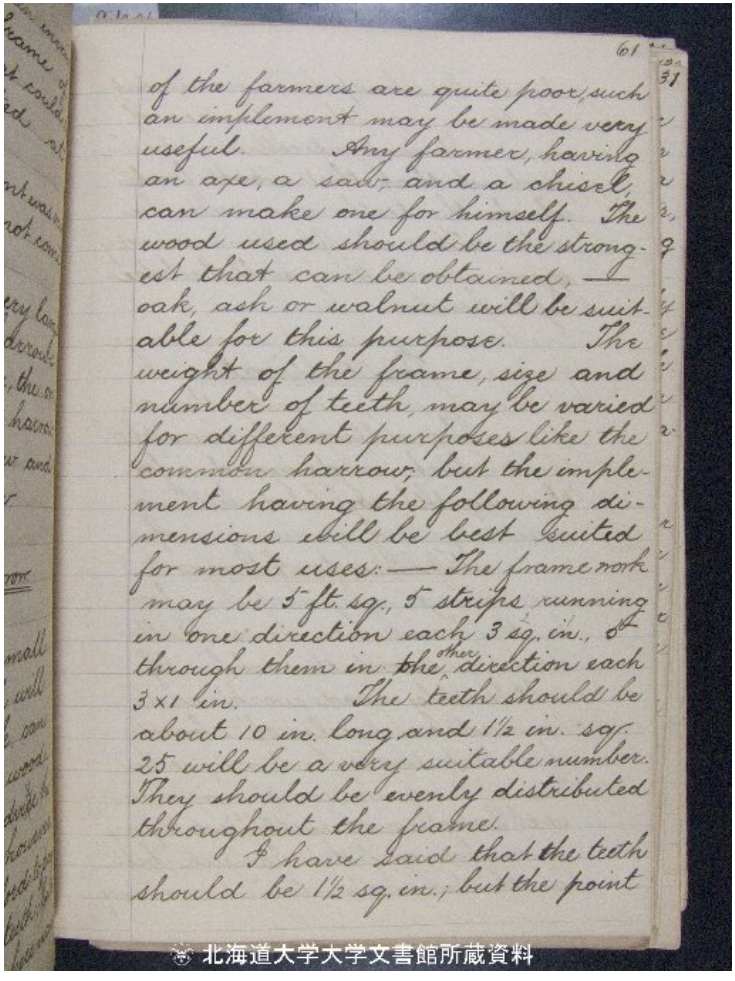
This implement was very expensive and has not come into general use.

At present, every large farmer could own harrows of three kinds; namely, the ordinary rectangular harrow, the pulverizing harrow and the smoothing harrow.

The Wooden Harrow.

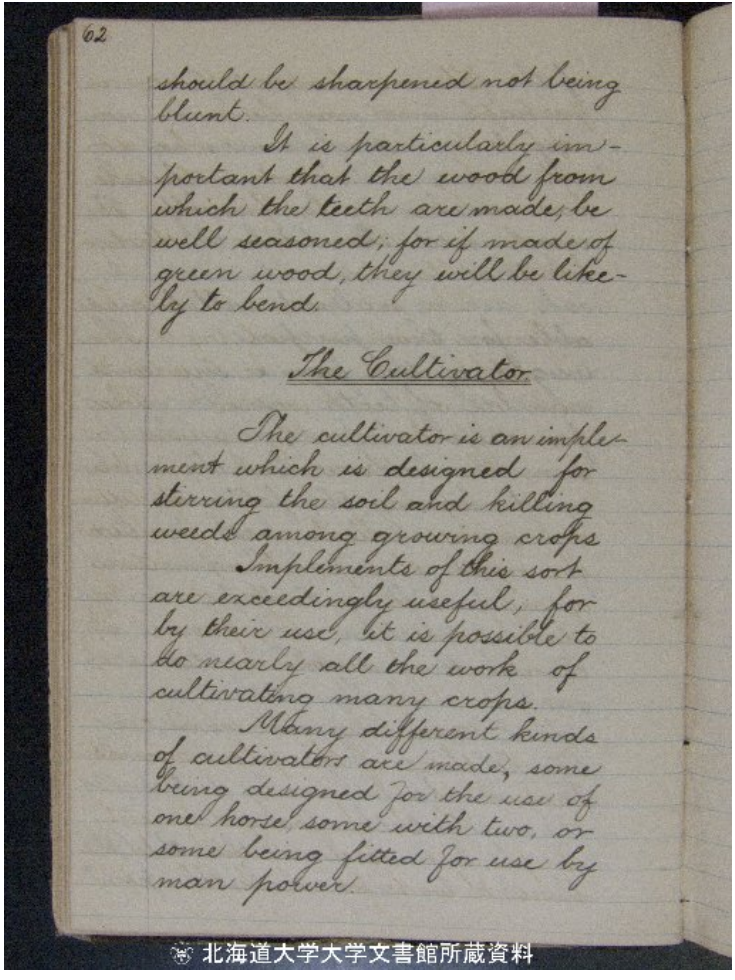
For use on a small scale, a harrow which will do tolerably good work, can be made entirely of wood.

I would not advise the use of such harrow, however, if the farmer can afford to pay for a harrow of iron teeth; but in this new country where many



of the farmers are quite poor, such an implement may be made very useful. Any farmer, having an axe, a saw, and a chisel, can make one for himself. The wood used should be the strongest that can be obtained, —— oak, ash or walnut will be suitable for this purpose. The weight of the frame, size and number of teeth, may be varied for different purposes like the common harrow; but the implement having the following dimensions will be best suited for most uses: —— The frame work may be 5 ft. sq., 5 strips running in one direction each 3 sq. in., 5 through them in the other direction each 3×1 in. The teeth should be about 10 in. long and 1 1/2 in. sq. 25 will be a very suitable number. They should be evenly distributed throughout the frame.

I have said that the teeth should be 1 1/2 sq. in.; but the point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should be sharpened not being blunt.

It is particularly important that the wood from which the teeth are made, be well seasoned; for if made of green wood, they will be likely to bend.

The Cultivator.

The cultivator is an implement which is designed for stirring the soil and killing weeds among growing crops.

Implements of this sort are exceedingly useful; for by their use, it is possible to do nearly all the work of cultivating many crops.

Many different kinds of cultivators are made, some being designed for the use of one horse, some with two, or some being fitted for use by man power.

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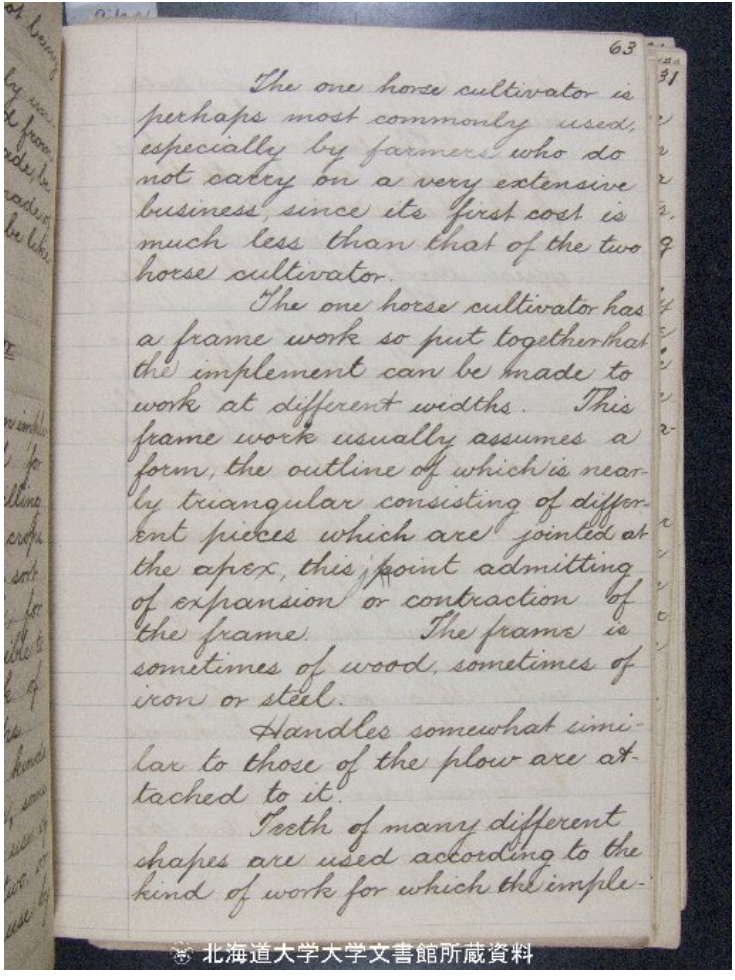
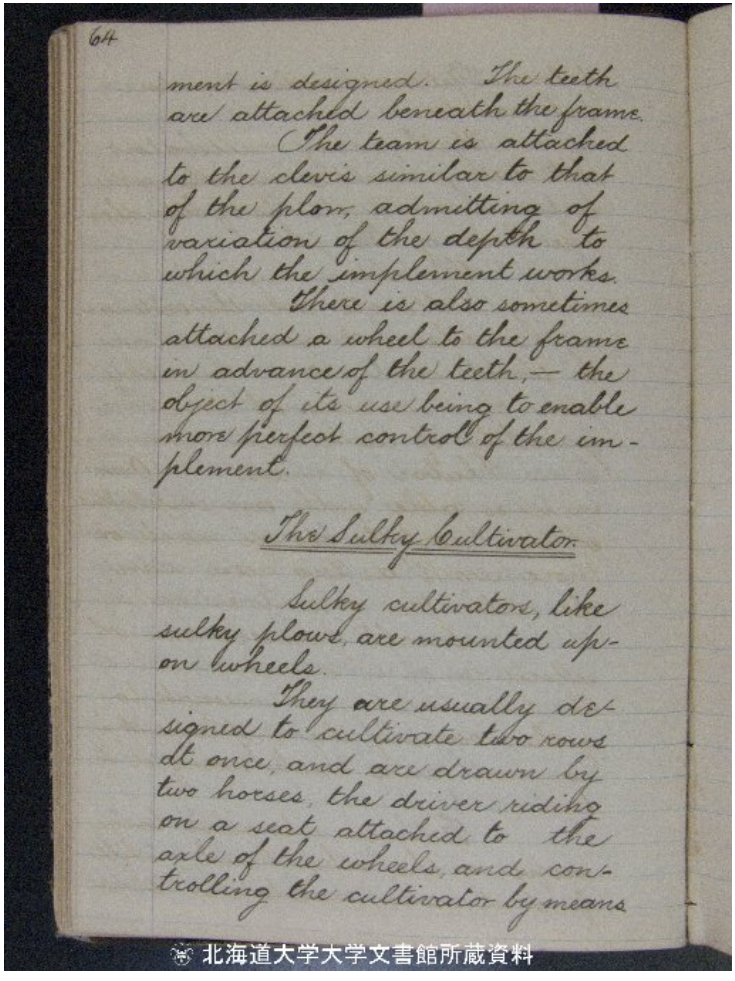


The one horse cultivator is perhaps most commonly used, especially by farmers who do not carry on a very extensive business, since its first cost is much less than that of the two horse cultivator.

The one horse cultivator has a frame work so put together that the implement can be made to work at different widths. This frame work usually assumes a form, the outline of which is nearly triangular consisting of different pieces which are jointed at the apex, this joint admitting of expansion or contraction of the frame. The frame is sometimes of wood, sometimes of iron or steel.

Handles somewhat similar to those of the plow are attached to it.

Teeth of many different shapes are used according to the kind of work for which the implement



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ment is designed. The teeth are attachld beneath the frame.

The team is attached to the clevis similar to that of the plow, admitting of variation of the depth to which the implement works.

There is also sometimes attached a wheel to the frame in advance of the teeth, — the object of its use being to enable more perfect control of the implement.

The Sulky Cultivator.

Sulky cultivators, like sulky plows, are mounted upon wheels.

They are usually designed to cultivate two rows at once, and are drawn by two horses, the driver riding on a seat attached to the axle of the wheels, and controlling the cultivator by means

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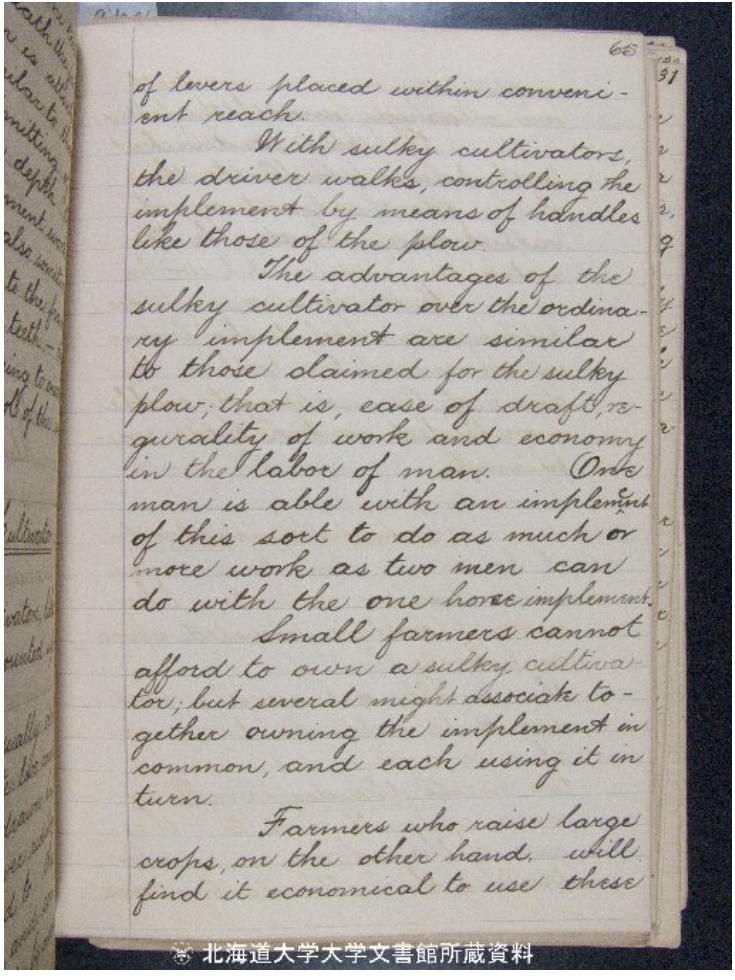


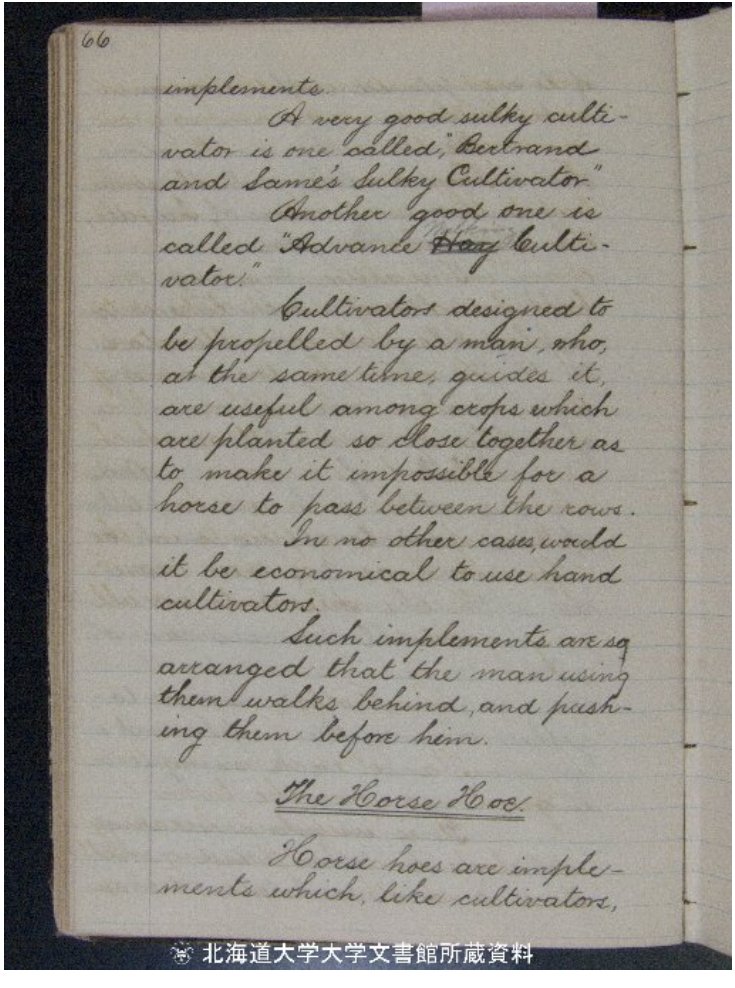
of levers placed within convenient reach.

With sulky cultivators, the driver walks, controlling the implement by means of handles like those of the plow.

The advantages of the sulky cultivator over the ordinary implement are similar to those claimed for the sulky plow; that is, case of draft, regurality of work and economy in the labor of man. One man is able with an implement of this sort to do as much or more work as two men can do with the one horse implement.

Small farmers cannot afford to own a sulky cultivator; but several might associate together owning the implement in common, and each using it in turn.

Farmers who raise large crops, on the other hand, will find it economical to use these


66

implements.

A very good sulky cultivator is one called, "Bertrand and Same's Sulky Cultivator."

Another good one is called "Advance ~~Harg~~ Walking Cultivator."

Cultivators designed to be propelled by a man, who, at the same time, guides it, are useful among crops which are planted so close together as to make it impossible for a horse to pass between the rows.

In no other cases, would it be economical to use hand cultivators.

Such implements are sq arranged that the man using them walks behind, and pushing them before him.

The Horse Hoe.

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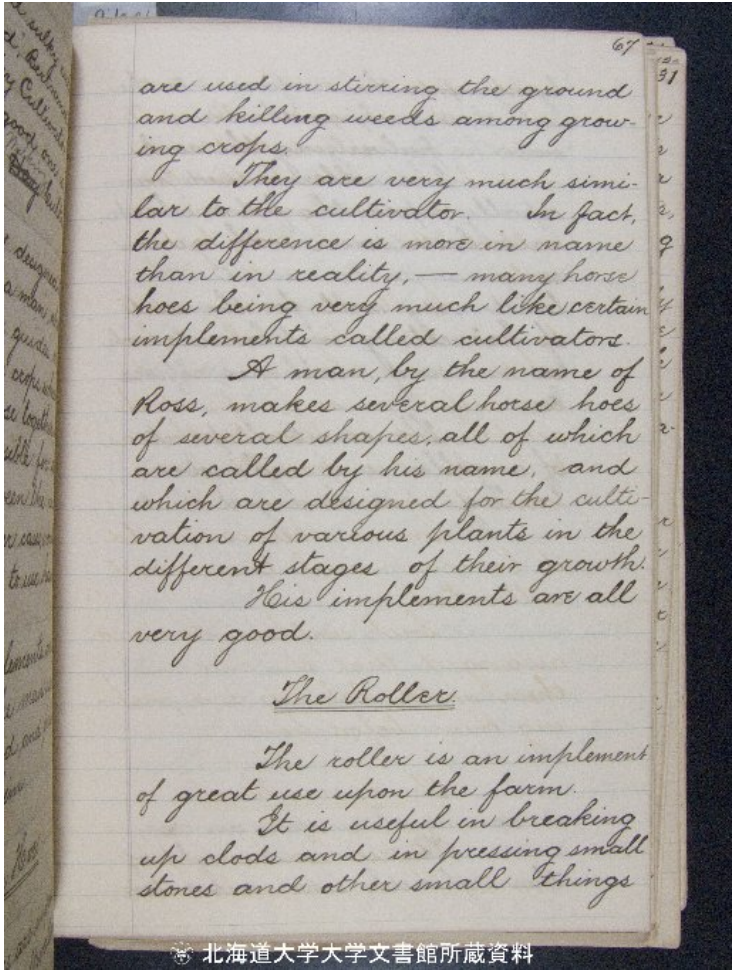


are used in stirring the ground and killing weeds among growing crops.

They are very much similar to the cultivator. In fact, the difference is more in name than in reality, —— many horse hoes being very much like certain implements called cultivators.

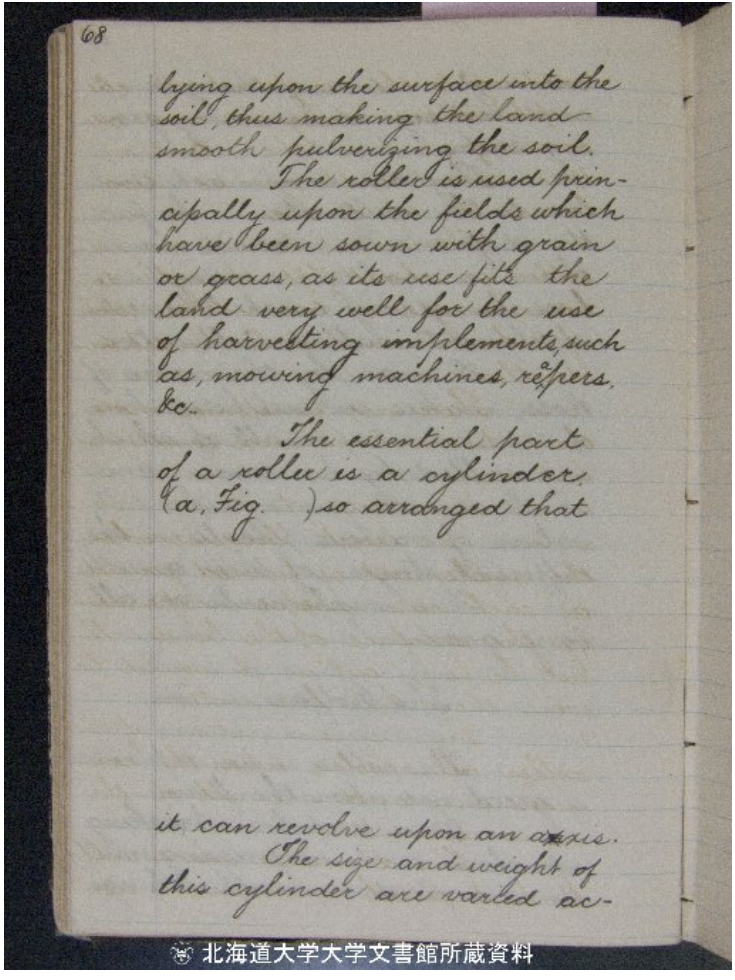
A man, by the name of Ross, makes several horse hoes of several shapes, all of which are called by his name, and which are designed for the cultivation of various plants in the different stages of their growth.

His implements are all very good.

The Roller.

The roller is an implement of great use upon the farm.

It is useful in breaking up clods and in pressing small stones and other small things

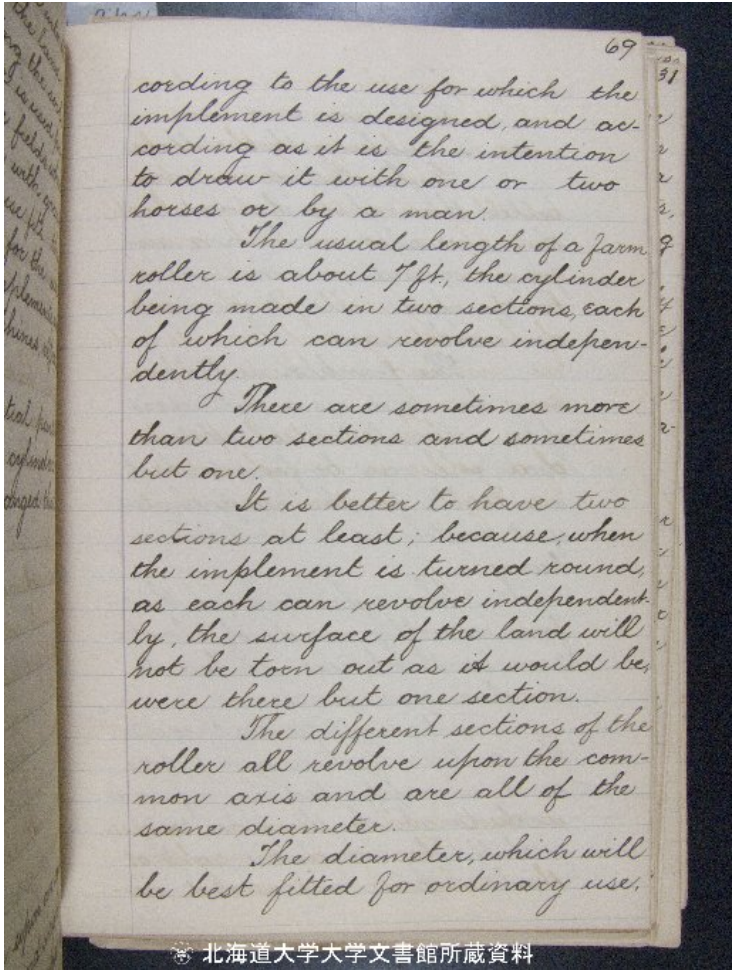


lying upon the surface into the soil, thus making the land smooth pulverizing the soil.

The roller is used principally upon the fields which have been sown with grain or grass, as its use fits the land very well for the use of harvesting implements, such as, mowing machines, reapers, &c..

The essential part of a roller is a cylinder, (a, Fig.) so arranged that it can revolve upon an axis.

The size and weight of this cylinder are varied according



to the use for which the implement is designed, and according as it is the intention to draw it with one or two horses or by a man.

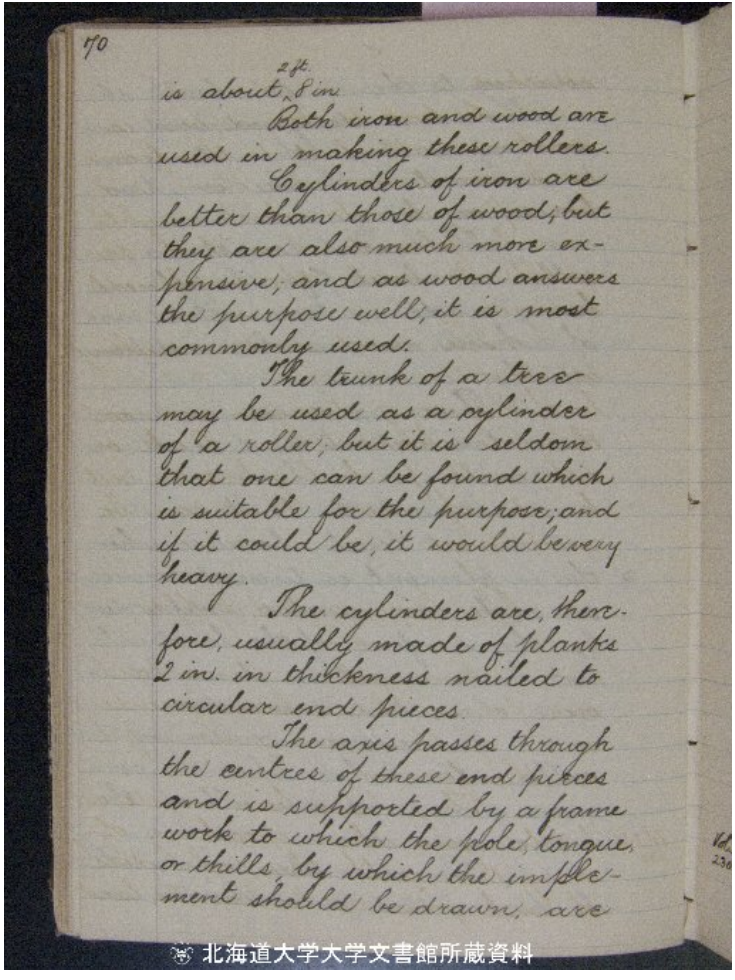
The usual length of a farm roller is about 7 ft., the cylinder being made in two sections, each of which can revolve independently.

There are sometimes more than two sections and sometimes but one.

It is better to have two sections at least; because, when the implement is turned round, as each can revolve independently, the surface of the land will not be torn out as it would be, were there but one section.

The different sections of the roller all revolve upon the common axis and are all of the same diameter.

The diameter, which will be best fitted for ordinary use,



is about 2 ft. 8 in.

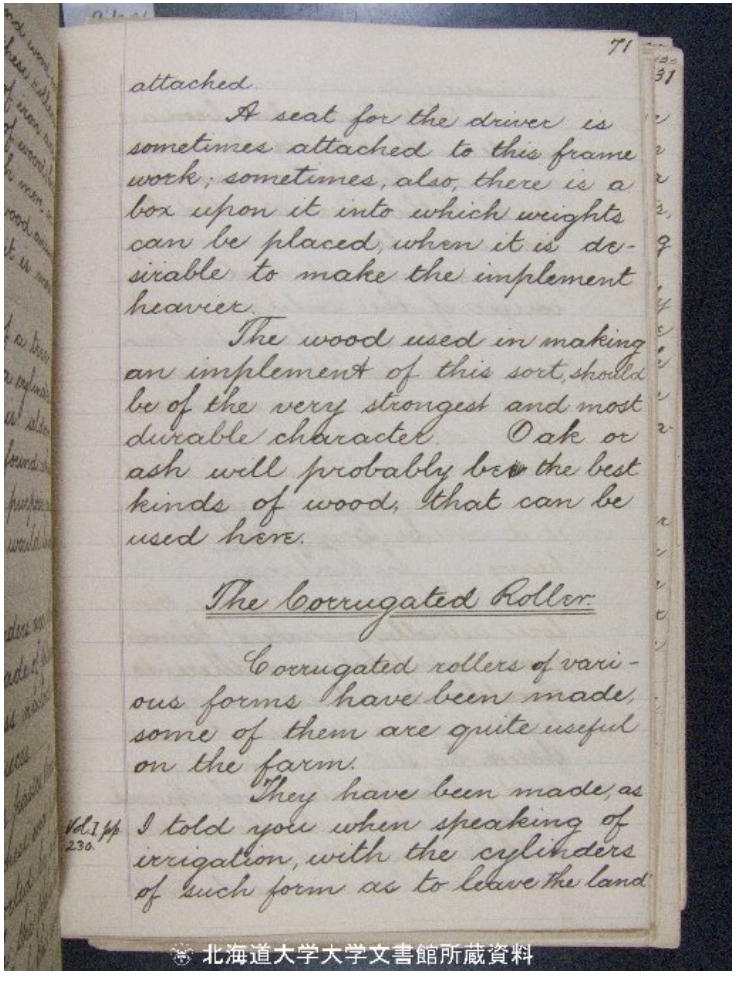
Both iron and wood are used in making these rollers.

Cylinders of iron are better than those of wood; but they are also much more expensive; and as wood answers the purpose well, it is most commonly used.

The trunk of a tree may be used as a cylinder of a roller; but it is seldom that one can be found which is suitable for the purpose; and if it could be, it would be very heavy.

The cylinders are, therefore, usually made of plants 2 in. in thickness nailed to circular end pieces.

The axis passes through the centres of these end pieces and is supported by a frame work to which the pole, tongue, or thills, by which the implement should be drawn, are



attached.

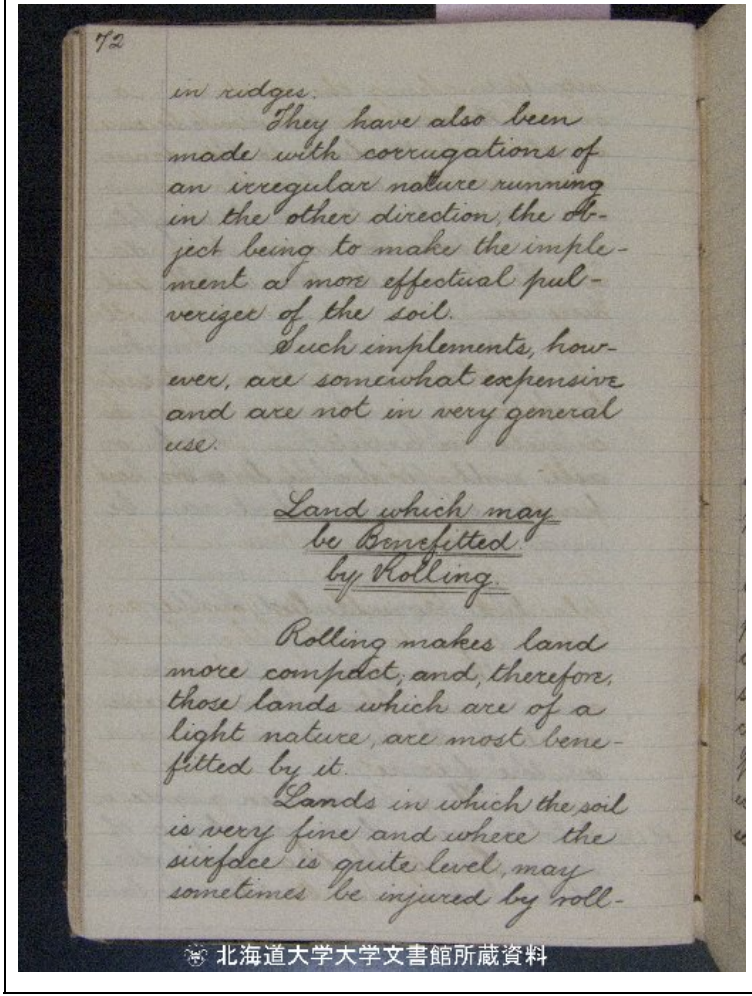
A seat for the driver is sometimes attached to this frame work; sometimes, also, there is a box upon it into which weights can be placed, when it is desirable to make the implement heavier.

The wood used in making an implement of this sort, should be of the very strongest and most durable character. Oak or ash will probably be the best kinds of wood, that can be used here.

The Corrugated Roller.

Corrugated rollers of various forms have been made, some of them are quite useful on the farm.

They have been made, as I told you when speaking of irrigation, with the cylinders of such form as to leave the land



in ridges.

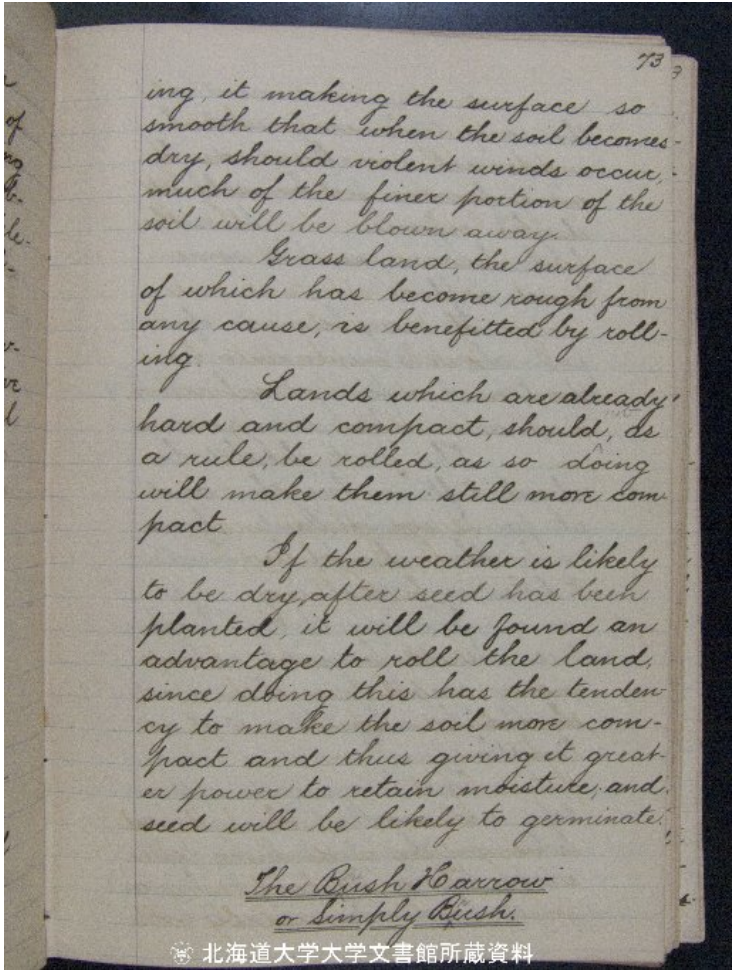
They have also been made with corrugations of an irregular nature running in the other direction, the object being to make the implement a more effectual pulverizer of the soil.

Such implements, however, are somewhat expensive and are not in very general use.

Land which may be Benefitted by Rolling.

Rolling makes land more compact; and, therefore, those lands which are of a light nature, are most benefitted by it.

Lands in which the soil is very fine and where the surface is quite level, may sometimes be injured by rolling,



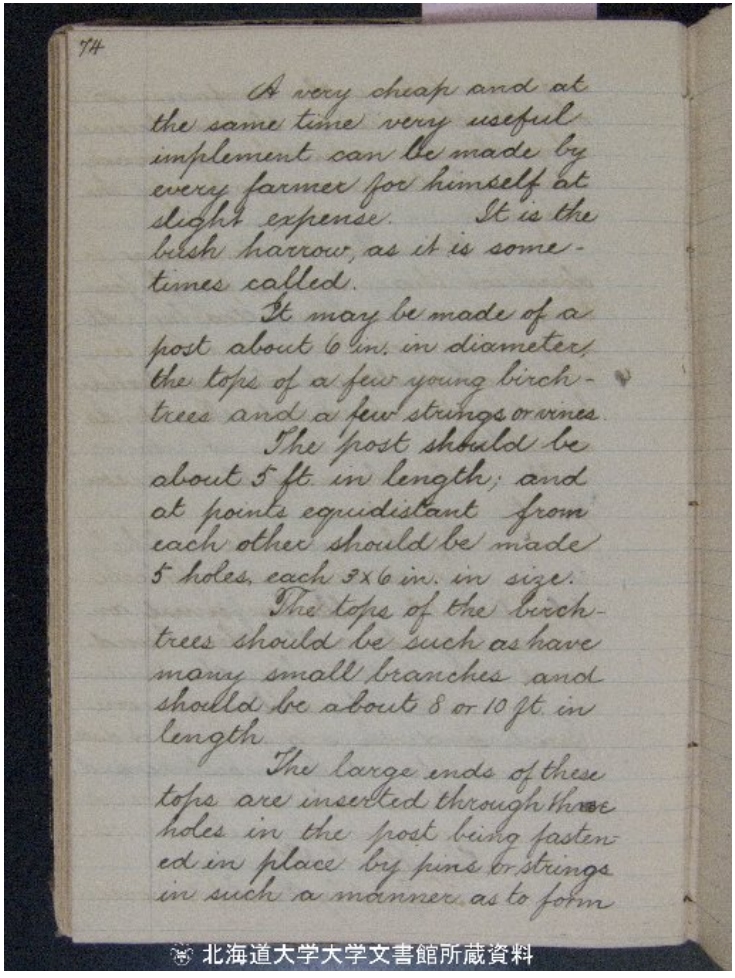
it making the surface so smooth that when the soil becomes dry, should violent winds occur, much of the finer portion of the soil will be blown away.

Grass land, the surface of which has become rough from any cause, is benefittd by rolling.

Lands which are already hard and compact, should, as a rule, be rolled as so doing will make them still more compact.

If the weather is likely to be dry, after seed has been planted, it will be found an advantage to roll the land, since doing this has the tendency to make the soil more compact and thus giving it greater power to retain moisture; and, seed will be likely to germinate.

The Bush Harrow
or Simply Brush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A very cheap and at the same time very useful implement can be made by every farmer for himself at slight expense. It is the bush harrow, as it is sometimes called.

It may be made of a post about 6 in. in diameter, the tops of a few young birch-trees and a few strings or vines.

The post should be about 5 ft. in length; and at points equidistant from each other should be made 5 holes, each 3×6 in. in size.

The tops of the birch-trees should be such as have many small branches and should be about 8 or 10 ft. in length.

The large ends of these tops are inserted through the holes in the post being fasten-ed in place by pins or strings in such a manner as to form

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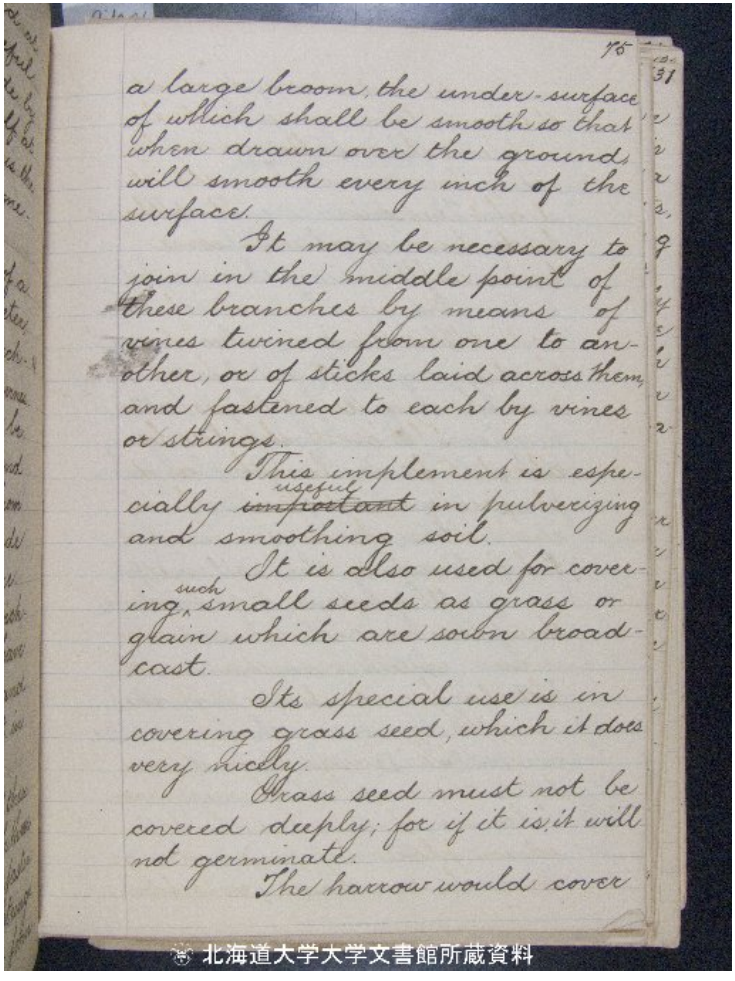


a large broom, the under-surface of which shall be smooth so that when drawn over the ground, will smooth every inch of the surface.

It may be necessary to join in the middle point of these branches by means of vines twined from one to another, or of sticks laid across them, and fastened to each by vines or strings.

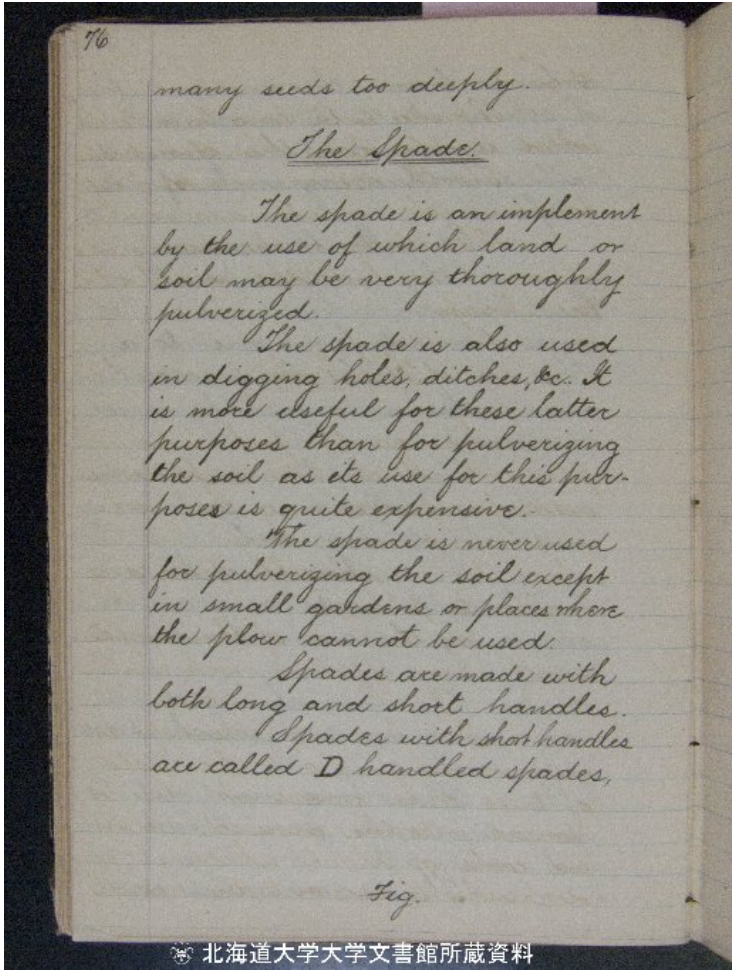
This implement is especially useful in pulverizing and smoothing soil.

It is also used for covering such small seeds as grass or grain which are sown broadcast.

Its special use is in covering grass seed, which it does very nicely.

Grass seed must not be covered deeply; for it is, it will not germinate.

The harrow would cover



many seeds too deeply.

The Spade

The spade is an implement by the use of which land or soil may be very thoroughly pulverized.

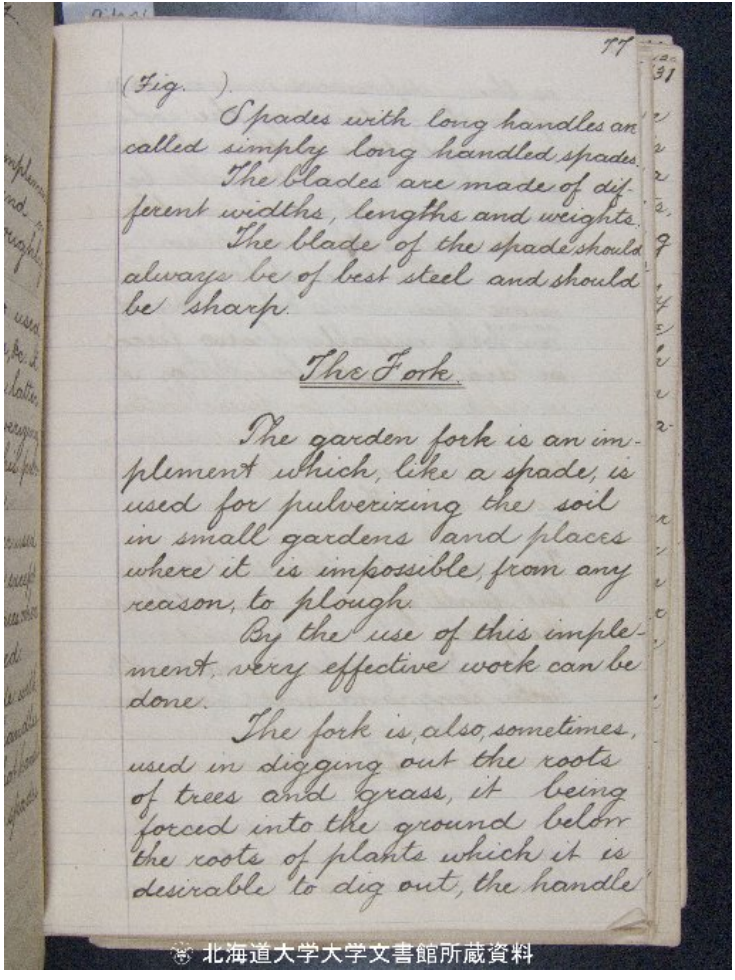
The spade is also used in digging holes, ditches, &c.. It is more useful for these latter purposes than for pulverizing the soil as its use for this purpose is quite expensive.

The spade is never used for pulverizing the soil except in small gardens or places where the plow cannot be used.

Spades are made with both long and short handles.

Spades with short handles are called D handled spades,

Fig.



(Fig.)

Spades with long handles are called simply long handled spades.

The blades are made of different widths, lengths and weights.

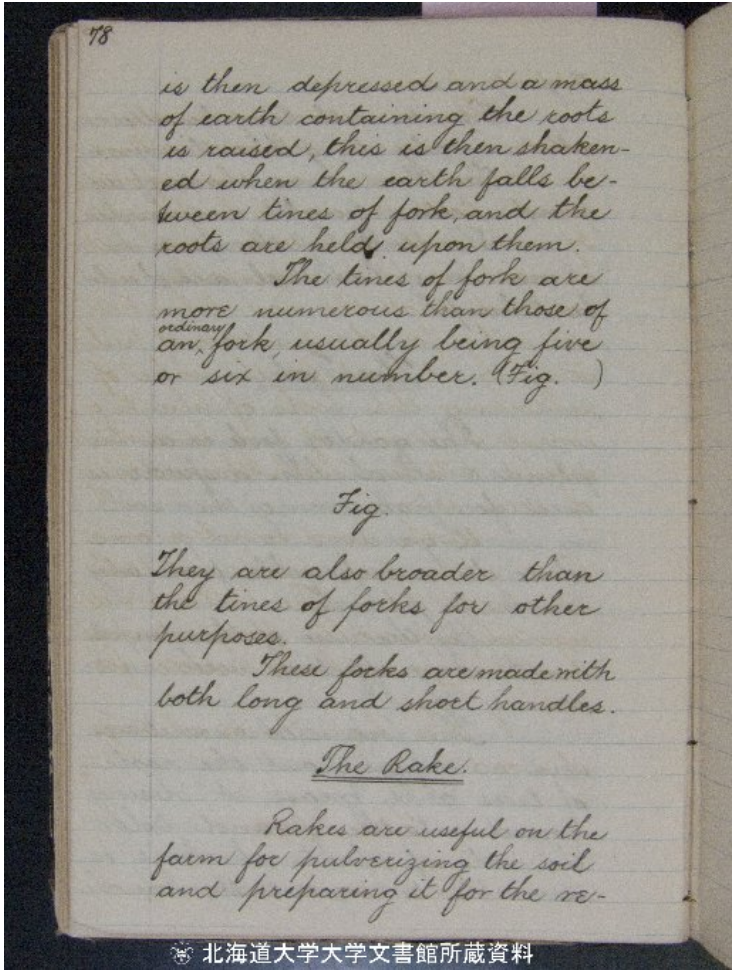
The blade of the spade should always be of best steel and should be sharp.

The Fork.

The garden fork is an implement which, like a spade, is used for pulverizing the soil in small gardens and places where it is impossible, from any reason, to plough.

By the use of this implement, very effective work can be done.

The fork is, also, sometimes, used in digging out the roots of trees and grass, it being forced into the ground below the roots of plants which it is desirable to dig out, the handle



is then depressed and a mass of earth containing the roots is raised, this is then shakened when the earth falls between tines of fork, and the roots are held upon them.

The tines of fork are more numerous than those of an ordinary fork, usually being five or six in number. (Fig.)

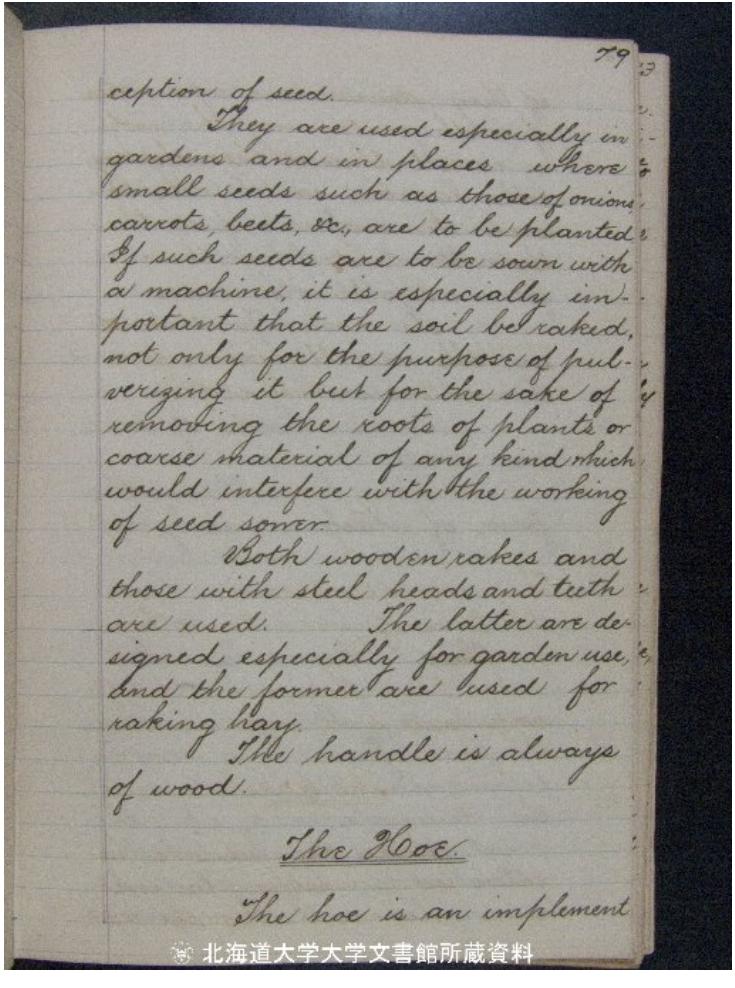
Fig.

They are also broader than the tines of forks for other purposes.

These forks are made with both long and short handles.

The Rake.

Rakes are useful on the farm for pulverizing the soil and preparing it for the reception



of seed.

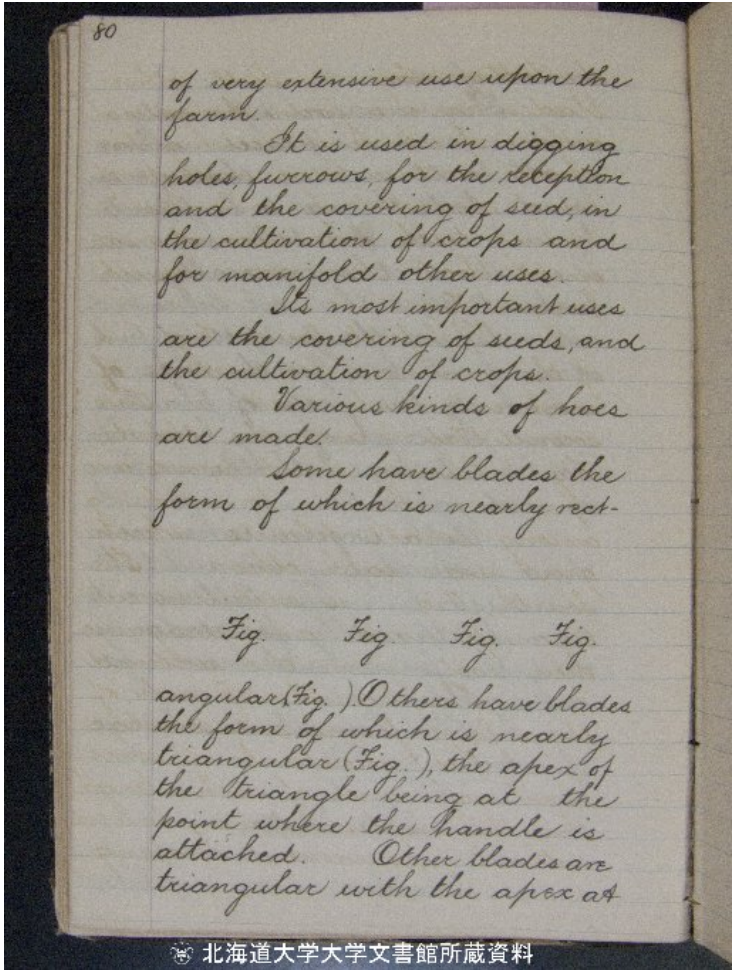
They are used especially in gardens and in places where small seeds such as those of onions carrots, beets, &c., are to be planted. If such seeds are to be sown with a machine, it is especially important that the soil be raked, not only for the purpose of pulverizing it but for the sake of removing the roots of plants or coarse material of any kind which would interfere with the working of seed sower.

Both wooden rakes and those with steel heads and teeth are used. The latter are designed especially for garden use, and the former are used for raking hay.

The handle is always of wood.

The Hoe.

The hoe is an implement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of very extensive use upon the farm.

It is used in digging holes, furrows, for the reception and the covering of seed, in the cultivation of crops and for manifold other uses.

Its most important uses are the covering of seeds, and the cultivation of crops.

Various kinds of hoes are made.

Some have blades the form of which is nearly rect-

Fig. Fig. Fig. Fig.

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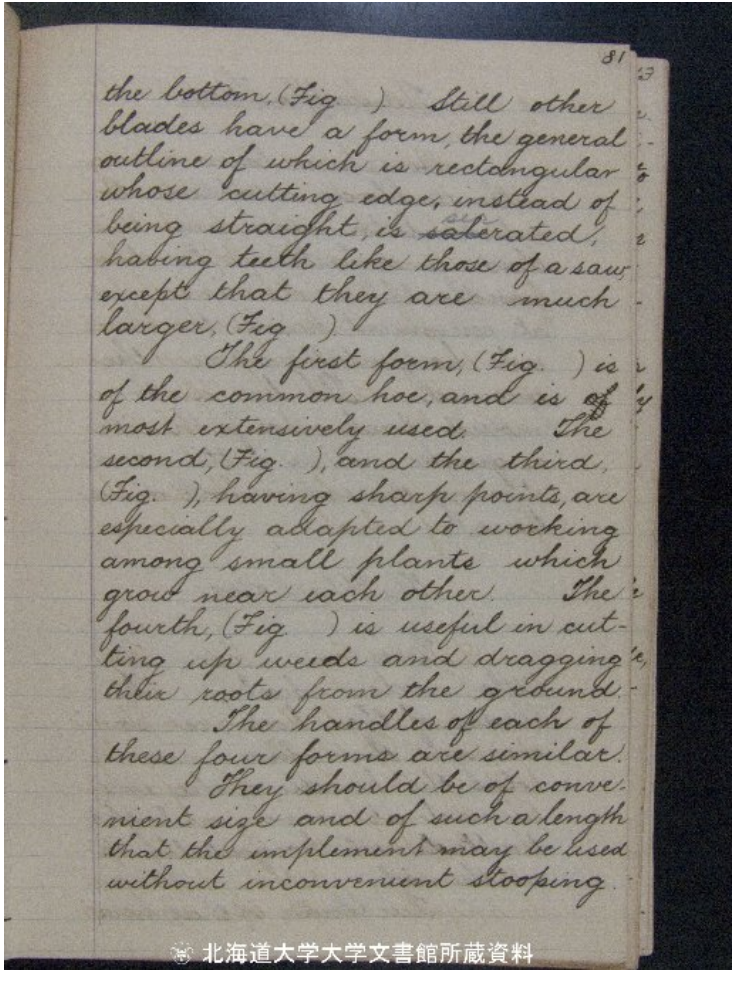
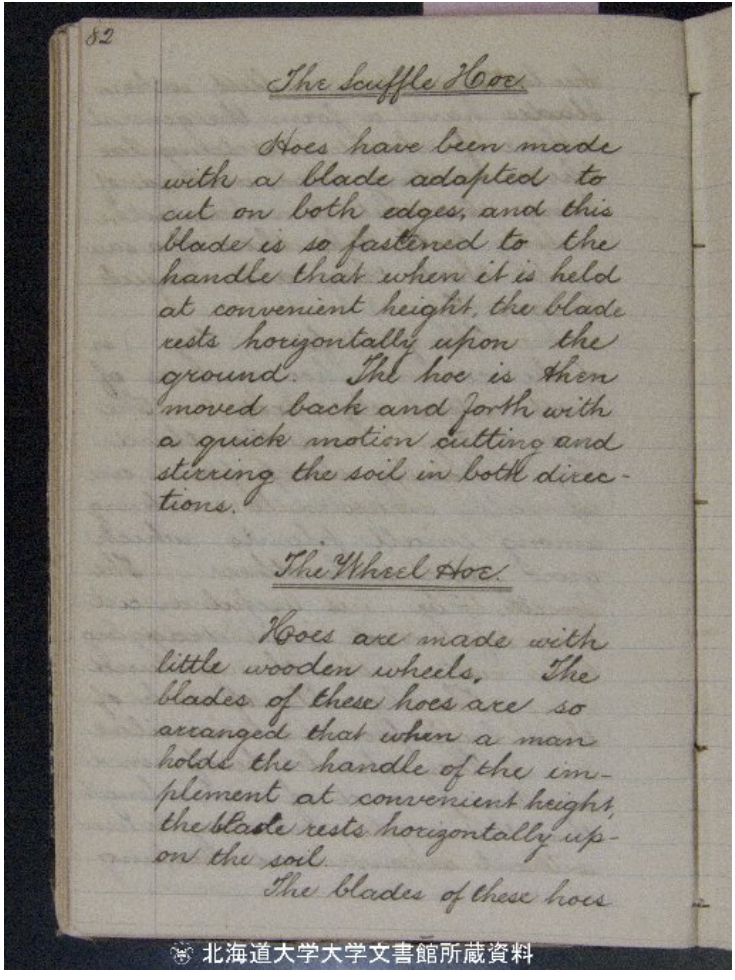


the bottom, (Fig.). Still other blades have a form, the general outline of which is rectangular whose cutting edge, instead of being straight, is serrated, having teeth like those of a saw, except that they are much larger, (Fig.).

The first form, (Fig.) is of the common hoe, and is most extensively used. The second, (Fig.), and the third, (Fig.), having sharp points, are especially adapted to working among small plants which grow near each other. The fourth, (Fig.) is useful in cutting up weeds and dragging their roots from the ground.

The handles of each of these four forms are similar.

They should be of convenient size and of such a length that the implement may be used without inconvenient stooping.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The Scuffle Hoe.

Hoes have been made with a blade adapted to cut on both edges, and this blade is so fastened to the handle that when it is held at convenient height, the blade rests horizontally upon the ground. The hoe is then moved back and forth with a quick motion cutting and stirring the soil in both directions.

The Wheel Hoe.

Hoes are made with little wooden wheels. The blades of these hoes are so arranged that when a man holds the handle of the implement at convenient height, the blade rests horizontally upon the soil.

The blades of these hoes

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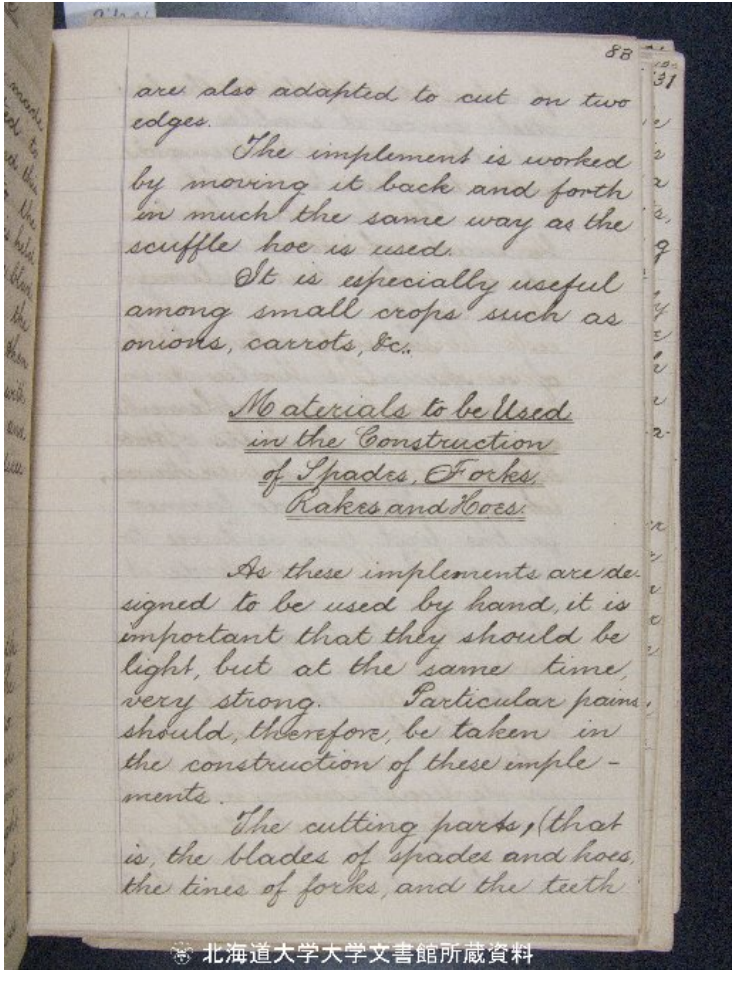


are also adapted to cut on two edges.

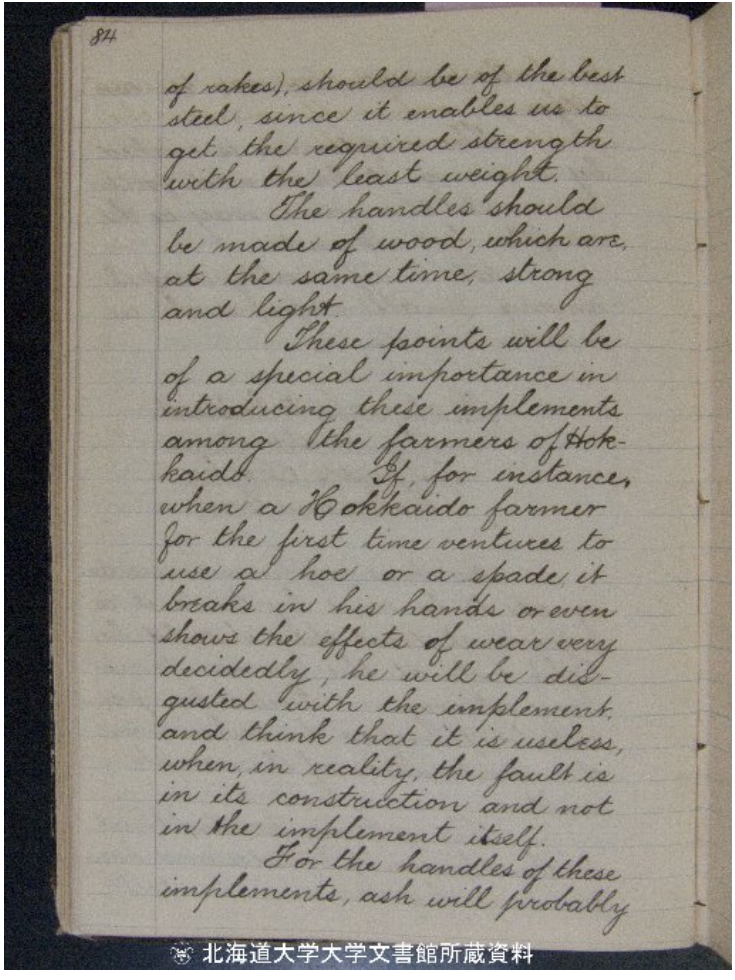
The implement is worked by moving it back and forth in much the same way as the scuffle hoe is used.

It is especially useful among small crops such as onions, carrots, &c..

Materials to be Used in the Construction of Spades, Forks, Rakes and Hoe

As these implements are designed to be used by hand, it is important that they should be light, but at the same time very strong. Particular pains should, therefore, be taken in the construction of these implements.

The cutting parts, (that is, the blades of spades and hoes, the tines of forks, and the teeth

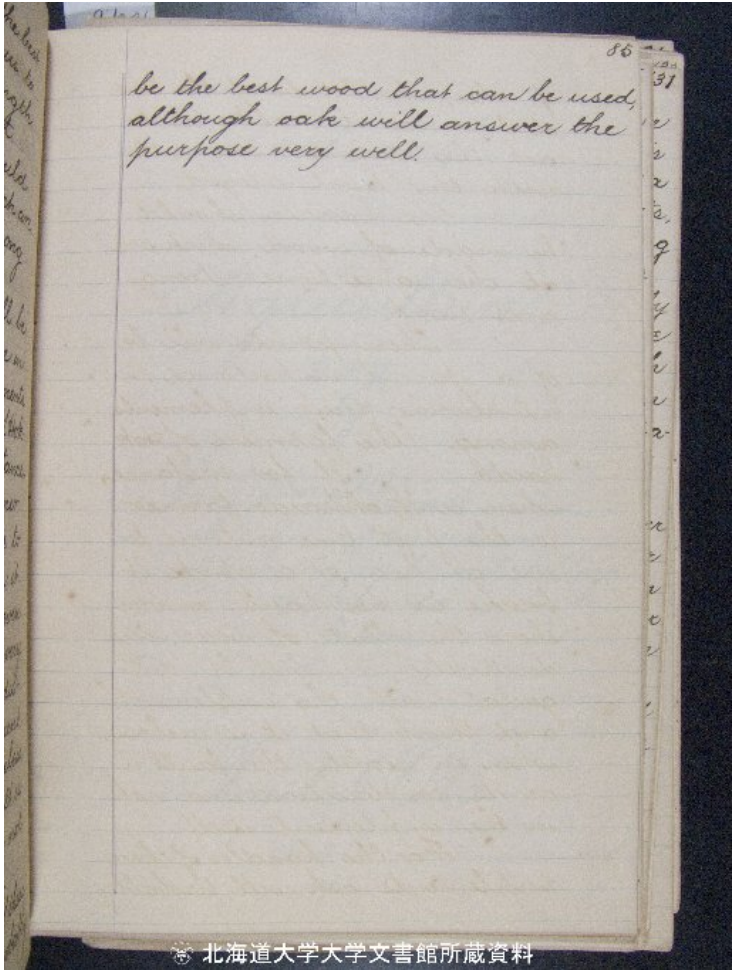


of rakes), should be of the best steel, since it enables us to get the required strength with the least weight.

The handles should be made of wood, which are, at the same time, strong and light.

These points will be of a special importance in introducing these implements among the farmers of Hokkaido. If, for instance, when a Hokkaido farmer for the first time ventures to use a hoe or a spade, it breaks in his hands or even shows the effects of wear very decidedly, he will be disgusted with the implement, and think that it is useless, when in reality, the fault is in its construction and not in the implement itself.

For the handles of these implements, ash will probably



be the best wood that can be used, although oak will answer the purpose very well.